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LESSONS LEARNED FROM THE LOGISTICS  
SUPPORT FOR COMMERCIAL OFF THE  
SHELF U.S. AIR FORCE EQUIPMENT

THESIS

Charles L. Clayton  
GS-11

AFIT/GLM/LSM/90S-11

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AFIT/GLM/LSM/90S-11

LESSONS LEARNED FROM THE LOGISTICS SUPPORT FOR  
COMMERCIAL OFF THE SHELF U.S. AIR FORCE EQUIPMENT

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

Charles L. Clayton, B.A.

GS-11

September 1990

Approved for public release; distribution unlimited

### Acknowledgments

First, I would like to thank my advisor, Professor Patrick M. Bresnahan, for his invaluable positive comments, ideas, and assistance to urge me to always think and write at my best.

Secondly, I would like to thank the many logisticians in the U.S. Air Force who participated in this research effort especially Mr. Lyle Teeter who provided the ideas for this research area. Without them, the effort would have been impossible.

Thirdly, I would like to thank my wife, Teresa, and daughter, Rachel, who spent many hours without me. Without their understanding and love, my effort would have been more difficult than I could imagine. Their support gave me additional energy to keep pressing forward with the project. Now we can spend more time together.

Fourthly, I would like to thank my classmates who served as sounding boards and encouraged me to try alternative approaches to difficult problems, especially my friend Ray Daly. His prayers and encouraging words will never be forgotten.

Finally, I would like to thank Jesus for giving me the right attitude and faith to believe this effort was possible in spite of the many roadblocks in the beginning.

Charles L. Clayton

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Abstract

Little documentation exists on the role of supporting commercial off the shelf (COTS) systems bought by the Air Force. Current USAF policy does not address the dynamic nature of buying and supporting COTS systems. The logistics support challenges associated with COTS equipment were explored through telephone interviews with USAF managers. The focus of this study is on the lessons learned by planning logistics support for COTS before, during, and after the enactment of the Defense Acquisition Improvement Act of 1986. Recommendations were made to (1) not fully provision COTS programs, (2) not convert commercial manuals to T.O.s, (3) streamline the acquisition process for COTS systems, (4) buy COTS systems in larger quantities to enjoy the savings from larger economies of scale, and (5) buy all engineering (type III) drawings when the COTS system is integrated with GFE (such as COMSEC equipment). Recommendations for further research were to (1) find COTS sources from foreign markets to enhance trade relationships with countries that have "friendly-nation" status, (2) find the practical methods to streamline the USAF's acquisition and support structure for buying COTS systems, and (3) identify all COTS programs that have successfully satisfied USAF mission requirements and have met budget constraints.

# "Lessons Learned from the Logistics Support for Commercial Off the Shelf U.S. Air Force Equipment"

## I. Overview

### Introduction

On 15 July 1985, President Reagan appointed Mr. David Packard (chief executive officer of Hewlett-Packard) to chair the Blue Ribbon Commission on Defense Management by Executive Order 12526. This was intended as a political measure to ward off Congressional inquiry on recent Defense Department acquisition problems. President Reagan primarily sought to head-off Congressional attacks on the Department of Defense through the independent commission. At that time, negative publicity about Defense acquisition costs was creating pressure within Congress to overhaul the current acquisition process. Representative William L. Dickinson, "ranking Republican on the House Armed Services Committee," had already proposed the idea of the independent commission in April 1985 as an effort "to investigate alleged defense problems and to coordinate reform proposals" (Heilman:3, Mann:21). The Packard Commission finished its initial assessment by February 1986 which was quickly accepted by President Reagan, and on 1 April 1986 he signed the National Security Decision Directive (NSDD) 219. NSDD 219 was President Reagan's approval of the Packard Commission's initial



findings. President Ronald Reagan had successfully defused the "political confrontation with Congress" over the acquisition problems in the Department of Defense (Heilman:3-4).

The Packard Commission's final report (which was consistent with the initial report) recommended, that:

Rather than relying on excessively rigid military specifications, DoD should make greater use of components, systems, and services available "off-the-shelf." It should develop new or custom made items only when it has been established that those readily available are clearly inadequate to meet military requirements.

No matter how DoD improves its organization or procedures, the defense acquisition system is unlikely to manufacture products as cheaply as the commercial marketplace. DoD cannot duplicate the economics of scale possible in products serving a mass market, nor the power of the free market system to select and perpetuate the most innovative and efficient producers. When a "make or buy" decision must be made, the presumption should be to buy (Packard:60).

In other words, the Packard Commission was proposing the Department of Defense buy more off-the-shelf (nondevelopmental items) rather than custom made (developmental, MIL-SPEC, items) equipment and supplies. The President's endorsement of these recommendations was accepted by Congress as the measures needed to fix the DoD acquisition problems. These policies were incorporated into Public Law 99-961 under Section 907 titled "Preference for Nondevelopmental Items" in the Defense Acquisition Improvements Act of 1986 and became law on 14 November 1986 (DOD 1987a:2).

The Defense Acquisition Improvement Act of 1986 changed the DoD's acquisition policies significantly because it

stated "the Secretary of Defense shall ensure that, to the maximum extent practicable, . . ." consider fulfilling requirements "through the procurement of nondevelopmental items" (U.S. Congress:10 U.S. Code 2325). The Act defines nondevelopmental items as follows:

- (1) Any item of supply that is available in the commercial marketplace;
- (2) Any previously-developed item of supply that is in use by a department or agency of the United States, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;
- (3) Any item of supply in paragraphs (1) or (2) that requires only minor modification in order to meet the requirements of the procuring agency; or
- (4) Any item of supply that is currently being produced that does not meet the requirements (1), (2), or (3) solely because the item--
  - a. Is not yet in use; or
  - b. Is not yet available in the commercial marketplace.

Additionally, this Act required the Secretary of Defense to report actions taken to implement the law within 180 days. Hence, Secretary of Defense, Caspar Weinberger appointed Dr. James R. Burnett (Vice President, deputy general manager of TRW's E&D Systems Group (Marquis: 435)) and Dr. William J. Perry (President of H&Q Technical Partners, Incorporated (Marquis: 2429)) to co-chair the "1986 Summer Study" of the Defense Science Board to find out how to implement the new law (DoD 1987b:vii).

The government uses the term commercial-off-the-shelf known as COTS. Commercial-off-the-shelf (COTS) items are defined as a subset of nondevelopmental items, which do not require development by government planners. The more accepted definition for COTS type equipment is as follows: "a commercial item is an item developed and used for other than government purposes; sold or traded to the general public in the course of normal business operations, and (ideally) used unchanged (off-the-shelf) when acquired by the government" (Sacramento:1). The opposite of COTS type equipment is developmental or MIL-SPEC systems. MIL-SPEC equipment is defined as:

The classic military approach to design and construction: a government design for government use. The Government is financing the design effort, will ultimately own and control the design, and intends that it be rugged enough to withstand battlefield use. The design philosophy and selection of parts are strictly according to military specifications and standards, and, typically, the cost is high (Sacramento:1).

To gain a further understanding of where COTS can and can not be used in the Air Force, the literature defined some categories as unsuitable for COTS acquisition. Proposals by Dr. Burnett and Dr. Perry in the "Defense Science Board 1986 Summer Study on Use of Commercial Components in Military Equipment" clearly disqualify certain military hardware for COTS acquisition fitting into the following categories: "nuclear propulsion, certain fuels, combat aircraft, missile systems, explosive munitions and propellants, destructive weapons, space systems, and radiation hard equip-

ment; commercial components and practices still may be applicable" (DoD 1987b:17).

Traditional lead times from the conception phase to production phase were greatly reduced with COTS acquisitions versus MIL-SPEC items. Program managers and logisticians have fewer tasks to analyze with COTS systems because commercial systems are already fully developed, and allow earlier fielding times. Since COTS systems were in the marketplace, the Government did not have to fund and then wait for the design effort (Sacramento:3). The reduction in lead times for the production phase for COTS systems often results in fielding the systems significantly sooner, 90 days to one year versus three to four years for MIL-SPEC items (Teeter 1989a:1). This could cause problems for Air Force logisticians because "the schedule of a COTS acquisition may be so accelerated that the time to complete the provisioning process could very well delay the deployment of the system" (Schumacher:32).

The provisioning process is defined as follows:

"The process of determining and acquiring the range and quantity (depth) of spares and repair parts, and support and test equipment required to operate and maintain an end item of material for an initial period of service" (MIL-STD-1388-1A).

Here-in lies the problem with COTS. COTS systems may be fielded before their spare/repair parts and support

equipment are available. For a COTS system to operate from the first day to its expected failure point (mean time between failure MTBF), the Air Force must have a preestablished network of repair and support requirements satisfied. This network could simply be arrangements between the Air Force and the vendor to ship broken COTS items to the supplier's repair center as part of the warrantee, and a plan to borrow or lease substitutes until the COTS items are returned. But, this simplification ends when the COTS items are located around the globe (as are Air Force bases) and are operating after the warrantee period.

To protect mission requirements beyond the initial fielding and warranty period, Air Force planners must use more intense network support plans such as prepositioned spare parts for unexpected breakdowns and field training classes for new operators and maintainers. This planning (the provisioning process) may be extensive and require time horizons greater than six months to interface the support requirements to the fielded COTS system.

The provisioning process used to support developmental items (MIL-SPEC) is comprehensive. Logisticians use an integrated logistics support (ILS) approach to study the impacts of support requirements on the life cycle cost and readiness for proposed MIL-SPEC acquisitions. ILS development may take up to five years for new systems (ILS Support Guide:4-5). ILS development time greater than one year is

not adequate for COTS systems that can be acquired in 90 days to one year. If logisticians use the same planning horizons and techniques for COTS items that they currently use to plan support for MIL-SPEC items, then logisticians will need more time to plan and acquire logistics support for COTS items.

Before the buying can begin, all of the logistics support areas for COTS systems must be assessed. Without logistics support, a COTS system may not be supportable beyond its warranty period. Therefore, the logistics support planning requirements for COTS systems are identical to the planning requirements for MIL-SPEC systems and must be finished before buying the COTS system. Examples of planning requirements include providing maintenance, spare parts, facilities, support equipment, technical publications, computer support, packaging, storage, handling, and transportation. These planning requirements must be evaluated for the system's entire useful life. In some cases, the first to the last day of operation could span more than a decade.

However, the shortened acquisition cycle for COTS systems and the peculiarities of commercial systems often cause significant hurdles for DoD logistics planners. Since the procurement lead times take as long as three to four years for MIL-SPEC systems, logisticians have two or three years to develop comprehensive Integrated Logistics Support Plans. The meticulous detail needed to plan integrated logistics

support for MIL-SPEC systems is no different for COTS systems. The same issues logisticians address while evaluating developmental items must also be evaluated when considering COTS systems, and the time element available to MIL-SPEC items is not available for COTS items. Support requirements can not simply be neglected in order to save time when fielding new COTS systems because the acquisition time may be reduced from three to four years to as little as 90 days.

#### Purpose

The purpose of this research thesis will be to explore the logistics support challenges that Air Force logisticians face when working with COTS equipment, and to investigate the lessons they learned by planning the support for COTS equipment/systems before, during, and after the enactment of the Defense Acquisition Improvement Act of 1986.

#### Specific Problem

Current Air Force policy on logistics support does not address the dynamic nature of buying and supporting COTS systems. This lack of policy has created a need for guidance to buy and support COTS systems. As the trend towards commercial buying increases in the DoD, this policy shortfall will become more acute to our Air Force logisticians.

Many logisticians plan the support packages for COTS systems for the Air Force based upon older policy directives written around systems and major pieces of equipment

peculiar to the MIL-SPEC development process. Since the Defense Acquisition Improvement Act for 1986, some guidance has been provided in "The COTS Book" distributed by the Sacramento Acquisition Logistics Center (Sacramento) to logisticians in the Air Force Communications Command (AFCC), Air Force Logistics Command (AFLC), and Air Force Systems Command (AFSC). Continuing difficulties in the support of COTS systems have drawn the attention of both commanders of AFLC and AFSC (Teeter, 1989a: 1-2). During the 22-23 March 1989 AFSC/AFLC Joint Commanders' Conference held at Wright-Patterson AFB, Generals Alfred G. Hansen (Commander of AFLC) and Bernard P. Randolph (Commander of AFSC) agreed to establish a working group to develop policies and procedures for determining COTS requirements and the resulting acquisition and support decisions (Hansen:1). The working group was to be led by Mr. Richard Bleau a senior logistician at Electronic Systems Division (ESD/PLL), Hanscom AFB MA and was directed (tasked) to do the following (Hansen:1):

Develop a draft charter for approval by HQ AFSC/PL, HQ AFLC/MM, AFCC/CV and ALD/CC.

Notify appropriate commands and organizations to identify working group members.

Assemble the COTS working group and complete the study after approval of the charter.

Report findings and recommendations to the first AFSC/AFLC Joint Commanders' Conference, which occurs after completion of the study, for inclusion as Air Force policy.



One of the primary COTS logistics support objectives is to get logistics support strategies up front as early as possible (Bleau).

### Investigative Questions

To focus this research, the following questions will be used to guide the investigation:

1. What impact does the new acquisition initiatives created by the Defense Acquisition Improvement Act of 1986 have on the current logistics planning process for Air Force COTS systems?

2. How have Air Force logisticians adapted to shorter acquisition cycles for COTS systems and equipment?

3. What creative techniques have logisticians used to protect the Government's (DoD and U.S. Air Force) operations from COTS systems that become prematurely obsolescent and retired for use by the Air Force?

4. What kind of Air Force missions are best suited to use and support COTS equipment?

5. What have Air Force acquisition and logistics managers done to maximize the benefits of COTS systems and to minimize any other risks associated with buying and supporting these systems?

### Scope

The central theme of this research is to identify lessons learned and to identify trends in buying and supporting

COTS equipment and systems that will be useful to logisticians throughout the Air Force who may buy future COTS systems. The Air Force has bought many types of COTS systems over the years such as computers, test equipment, radios, ground electronics, audio visual, vehicles, and aircraft. Within the Air Force there are logisticians who have the "corporate memory" of the intricacies of supporting COTS systems. By tapping the information from these corporate experts, one can expect to uncover techniques and lessons learned from buying and supporting Air Force COTS systems. This information may be used as a foundation to formulate current logistics support policy for COTS systems.

To get a better idea how different Air Force managers approach individual peculiarities with COTS acquisitions, this research will seek out and interview these experts who have supported a variety of COTS systems located at various Air Force agencies. This will enable the researcher to study a variety of management styles and different logistics operations.

The primary focus of this research thesis will be to identify the management techniques used by Air Force logisticians who deal with COTS items. As more COTS systems are purchased in the Air Force, managers will become challenged to find information that will help them solve support problems specially related to COTS systems. The management techniques documented by this thesis may provide a useful

basis of information to future logisticians who will buy COTS items for the Air Force.

### Conclusion

COTS supportability issues have drawn the attention of the Commanders of AFLC and AFSC. By looking at a combination of equipments and management techniques used to support COTS systems used by the Air Force, this paper will identify the central points of lessons learned and current trends that may be used in the future to acquire newer COTS systems.

## II. Literature Review

### What is COTS?

An explanation of commercial-off-the-shelf (COTS) equipment may be described best by relating it in terms of the consumer who uses the system or equipment. When consumers are ready to buy a product or service they need, they go to a store or vendor who can supply the product or service. The vendor or store is open to the general public and sells its wares on the open market. The wares or services are mass marketed in some kind of store display or picture in a catalog available to shopping consumers. When the vendor makes a product or service that fits the needs of consumers at an affordable price, the business can expect a sales transaction with its customers. When items do not satisfy the consumer's needs, the products lose their value to customers and the vendor eventually pulls products off-the-shelf and replaces the products with more appealing (needed) wares.

One important point to make here is that the consumer makes no attempt to change the product design to fit it to special or unusual requirements (such as military use). The company does not have any contact with the consumer except through the store that sells its products. The customer has no input to the company other than by the purchasing "vote". Consumer demand is the direct message that is sent back to the manufacturing firm who redesigns or discontinues the

product or offers substitutes to satisfy the changing market needs in order to stay in business. Commercial products undergo this continuous change to allow vendors to maintain profits. Unlike custom products which are designed for a special customer, commercial products are designed for general public use. The public does not tell the producer how to make the product, ask for the design plans, spare parts, or for guarantees that the product will remain unchanged indefinitely (i.e. 10 to 20 years as do U.S. Air Force logisticians do with MIL-SPEC products).

COTS equipment is that type of equipment purchased by public consumers for use in their homes, non-for-profit organizations, and businesses. No modifications are required by the customer. The product is bought as-is off of the vendor's store shelf. The product is strictly intended for civilian use (Sacramento:2). The military is making expanded use of commercial equipment which could present some problems. Commercial equipment may or may not be able to withstand battlefield use or the rugged requirements for military use. In addition, support issues for COTS items must be fully evaluated to insure that COTS items will suit the mission requirements of a defined need.

#### Logistics Support for Commercial Off-the-Shelf (COTS) Defined.

Since COTS equipment is easily accessible in the civilian marketplace, the buying process appears to be easier

than buying MIL-SPEC items because there is no detailed design requirements (Sacramento:3). Buying COTS is popular for several other reasons. Cumbersome contracting paperwork requirements for developmental items may be eliminated that "drive away many of the best and technologically advanced suppliers" (Cohen:11). The service can also reduce the "cost of doing business with the government so that the government can accrue the advantages of lower cost and better products more often" (Cohen:11). Another reason COTS systems may be considered is that the government can "reduce development and procurement lead times by using existing commercial products more often" (Cohen:11). U.S. Air Force managers may feel pressured at the end of the fiscal year to spend uncommitted funds on easy to buy COTS equipment so Congress can be shown they are responsible by spending their programmed funds. Buying COTS equipment without considering the logistics support, as in the cases mentioned above, can be disastrous.

Should Air Force managers and users be able to identify COTS equipment, which may satisfy a need or mission, without considering the impact of the logistics support costs? There may be temptations to buy COTS equipment immediately if funds are available. This can be hazardous and faulty especially if the manager fails to analyze the full impacts of logistics support. According to Heilman, "commercial manufacturers are seldom concerned with military-style

configuration management" (Heilman:26). This is not the only concern with logistics support for COTS equipment. When COTS equipment is purchased, the manager gives up the right to access the design because the producer retains exclusive design rights guaranteed by U.S. trademark and patent laws. The manager also buys into the producer's support scheme which may have any number of options ranging from no support (i.e. disposable items) to factory maintenance and training. The manager also forfeits control over future modifications the producer may impose to satisfy public/civilian market demands. So, the simple COTS purchase originally considered by an Air Force manager or user can have detrimental mission impacts if these support peculiarities are not considered before the request for proposal (RFP) is published in the Commerce Business Daily.

When the Air Force manager gives up the right to access the equipment design, the risks to use COTS increase significantly. For example, if the producer goes out of business or quits making the COTS equipment before the end of the equipment's useful life, the fielded systems could become prematurely obsolete or retired early because spare parts will no longer be made or stocked by the company. Should the Air Force manager fail to fully assess the impact of the maintenance or service plan for the COTS equipment under consideration, the hidden or unexpected costs to keep the system operational may arise beyond expected life cycle

costs. For example, the producer could change the product design after the Air Force buys COTS. The repair parts may become incompatible as a result of the design change which could result in special and/or expensive design interfaces to fix older fielded systems, or worse, the broken fielded system may be retired early.

These constraints point out the negative support issues of buying COTS. The positive issues must also be discussed to fully define logistics support for COTS equipment. When a need is identified, funds are available, and Air Force managers decide they can live with the uncertainties of the support issues of COTS, the Air Force does not have to fund and wait for the design effort, and as a result, the Air Force can get an advanced product cheaper and faster (Sacramento:3). Other positive advantages include: current and advancing technologies, market based pricing, up front product identification and pricing, proven performance and reliability, and an existing support structure (Schumacher: 24). This whole positive issue is what the Packard Commission felt the DoD needed to do to cut costs (Packard:60).

When defining logistics support issues for any new Air Force system, the Air Force logistics planner is reminded of the acquisition logistics process in AFLC/AFSC Pamphlet 800-34:

The process of systematically identifying and assessing logistics alternatives, analyzing logistics alternatives, analyzing and resolving ILS (integrated logistics support) deficiencies, and managing ILS throughout



the acquisition process (Department of the Air Force Pamphlet 800-34:1-1).

Traditional developmental items (MIL-SPEC, such as the F-16 fighter aircraft) require intensive acquisition logistics management throughout the life of the system. The four key parts of acquisition logistics are: "the concept of life cycle cost (LCC); integrated logistics support and the (ten) ILS elements; integrated logistics support planning; and logistics support analysis" (Materna:5-1). According to Mr. Lyle Teeter (senior logistician at HQ Air Force Communications Command (AFCC):

The whole process was designed for research and development programs where the time span of the acquisition process allows for development of the logistics support to mature with the equipment acquisition.  
(Teeter 1989a:1)

Since COTS systems/equipment are brought on-line much sooner (90 days to one year at HQ AFCC), "most COTS systems arrive in the field without proper logistics support, regardless of (the) purchasing agency" (Teeter 1989a:1).

#### Logistics Support Policy

Current DoD and Air Force policy on COTS is seen by logisticians in the Air Force as "good, but do not go deep enough into the support area" (Teeter 1989a:1). The two most recent publications giving guidance on acquiring COTS are "The COTS Book" produced by Sacramento ALC and DoD Directive 5000.37 (DoD 1988:1-6). With the increasing trend towards buying commercial products to satisfy some Air Force

missions, the program manager or logistician will have to "factor-in very authoritative configuration control to his Nondevelopmental Item NDI/ (COTS) negotiations. The bottom line then is that we must take advantage of NDI/(COTS), but proceed carefully in the high tech areas when systems are not able to stand alone" (Feder:18). Mr. Teeter (AFCC/LG), states "we need standard operating procedures for the development of logistics support for COTS programs," . . . . and "we need an Air Force level look at the whole process to uncover the real problems, and build some fixes" (Teeter 1989a:2).

### Conclusion

Almost any item used in non-warfare missions may be considered a COTS candidate according to the Defense Science Board 1986 Summer Study. The trend in DoD acquisition will begin to lean towards buying more commercial products and services. Already HQ AFCC is buying most of their communications systems (such as BIDDS, Red Switch, and BISS/ESC) off-the-shelf (Teeter 1989a:1, Clark 1990). The challenging hurdles for Air Force logisticians will be to cope with a number of support issues when considering a COTS acquisition. Air Force policy on logistics support for COTS systems/equipment is shallow and currently undergoing review and development in the COTS working group at ESD Hanscom AFB, MA (HQ AFCC/AFLC/AFSC:V). The Air Force recognizes its shortcomings, yet the COTS acquisition and logistics support

contracts continue to be awarded for new test equipment, aircraft, vehicles, etc. The body of knowledge exists in the Air Force now that can resolve many of the negative logistics support issues for future COTS systems. Section III will describe the method to gather the techniques used by Air Force logisticians who plan support for COTS equipment on a day-to-day basis.

### III. Methodology

#### Overview

The purpose of this research thesis was to explore the challenges in supporting commercial-off-the-shelf (COTS) systems and to obtain practical lessons learned from Air Force logisticians who supported COTS systems after the Defense Acquisition Improvement Act of 1986. This research study will build a foundation for literature on buying and supporting COTS systems. This study may also be used by logisticians who want to discover how other logisticians support different kinds of COTS systems, and the study may encourage a cross exchange of ideas between the Air Force logistics community to improve the techniques needed to buy and support these systems. Another use of the study may be to encourage improvements in official Air Force acquisition and logistics policies through ad hoc committees for COTS systems.

#### Construction of the Questionnaire

The descriptive nature of this study lent itself towards obtaining logistics managers' opinions on how to support COTS systems in a dynamic environment. The choice for collecting this descriptive information was either a questionnaire designed for a mailed survey or a telephone (or personal) interview. The telephone interview presented the best alternative to collect the primary data for this

research thesis because the survey had the potential of non-response, and respondents were geographically separated at many locations around the United States. Even though the survey was cheaper to conduct and was more efficient than the telephone interview, the telephone interview allowed the researcher to ask probing questions from the respondents. Quality results were important because this study was establishing initial findings. The possible non-response from the survey technique could have jeopardized the study if the minimum sample size was not met.

There were also limitations considered when using the telephone interview technique for this research study:

1. The respondent had to be available.
2. There was a possibility that the respondent had moved to a new location that was different than the published number.
3. The length of the interview was limited by the respondent's interest in the subject.
4. It was not possible to use illustrations over the phone to further clarify questions by the interviewer.
5. Studies have shown that it has been easy for the respondent to terminate an interview early.  
(Emory: 170-1)

The initial questionnaire was developed to make the telephone interview interesting to the candidate by asking how candidates managed their programs. The questionnaire was also designed to be short (no longer than 30 minutes) to invite participation from these extremely busy managers.

To increase the efficiency and validity of the draft telephone questionnaire, it was presented to Ms. Maryanne Marshall, an acquisition logistics management specialist at HQ ESD/ALL who was developing COTS logistics support policies for the Air Force (Marshall: 1990). Ms. Marshall thought the draft questionnaire was too specific and not broad enough to encourage an open dialog for telephone interviews (her suggestions were incorporated into the final version). The 15 questions used in the questionnaire contained ideas that were considered to be the primary logistics support processes for COTS systems by Ms. Marshall and the researcher (see Attachment A). These questions also were designed to explore the management techniques currently used by Air Force logisticians who buy and support COTS systems.

#### Locating Logisticians Who Support COTS

Interviewing the logisticians who support COTS systems presented a significant challenge for two reasons. First, the Air Force supports COTS systems from many bases around the continental U.S. (CONUS), and the personal interview technique required travel funds during a period of budget reductions. Second, the time required to travel to all locations to conduct the personal interviews did not fit within the research time schedule.

### Data Collection

The telephone interview was selected over the personal interview because of the problems of traveling to the managers' work place. To minimize the problem with respondent availability, logistics managers were located by contacting the HQ AFLC Logistics Operations Center (LOC) at Wright-Patterson AFB, OH. The criterion for COTS systems (as described in the DSB Summer Study of 1986) were described to LOC personnel to locate logistics directorates around the Air Force that managed possible off-the-shelf programs. Once directorates were contacted, a list of candidates was secured, and the focus changed to the interview process.

### Interview Process

Before the interview process could begin, each of the candidates had to be contacted to solicit their participation in the research effort. To reduce the risk of early terminations by respondents during the telephone interview, the respondents were told that advanced copies would be mailed to further speed the interview process. Another reason for the advanced mailing was to allow managers time to collect their thoughts before the interview began and to incite a feeling that the interviewer cared about the manager's available time. A third reason for the advanced mailing was to serve as a reminder to the manager that they were part of an important research study that required their expert knowledge. The fourth reason served as a reminder to

the respondents that they had an appointment with the interviewer on their COTS system.

Each respondent was told they would be contacted within ten working days to schedule an appointment for the interview. The ten days between the solicitation call and the follow-up call allowed the Air Force and the Postal Service time to get the advanced copies of the questionnaire to the respondents through the Air Force's base distribution system and time for the respondents to review the questions. During the follow-up call, the respondents were asked if they had reviewed the questionnaire. After the respondents affirmed they had had time to review the questionnaire, they were asked for an interview appointment that best fit their schedule. This adaptive flexibility further enhanced the relationship between the respondent and the researcher to increase the probability that the respondent would participate in the research.

### Sampling Size

The focus of this research was on the experts who were working with logistics support for COTS systems. Purposive sampling was used to gather the primary data for the analysis (Section IV). Purposive sampling is nonprobabilistic in nature but conforms to certain criteria (Emory: 280). Judgement sampling was the primary purposive sampling technique used to select the experts who worked with COTS logistics support. Judgement sampling allowed the



researcher to selectively choose sample members who conformed to some criterion (Emory:280). The criterion used to handpick the sample members was based on the range of available COTS systems described in Section II.

Sampling size for nonprobabilistic samples can be debatable. For probabilistic research studies, the researcher can use statistical calculations to back into the sample size by estimating the size of the population for a desired confidence interval with a certain level of significance. With nonprobabilistic research, the researcher may not use traditional stochastic methods because the true cross section is not the aim of the research (Emory: 303). Since this study was exploratory in nature and focused on a specific criterion-based study that used nonprobabilistic judgement sampling, the sample size had to be representative of the experts' opinions who were managing logistics support for COTS. The researcher decided at least ten experts were needed to gain a useful insight on the methods used to manage logistics support for COTS systems.

#### Assumptions and Limitations

The danger of nonprobabilistic sampling occurs when the researcher and reader make generalizations that go beyond the scope of the COTS systems sampled. This research study was designed to be an exploratory study that will build a foundation for lessons learned about logistics support for COTS systems. Additional research will be required on COTS

systems outside those sampled for the reader to make stronger generalizations about how to support other types of COTS.

#### Sample COTS Systems

At least ten systems at different locations had to be studied to insure the sample size for the research was adequate to draw conclusions. The following list of equipments were identified to be used in the research thesis:

- |    |                         |                  |
|----|-------------------------|------------------|
| a) | CCSS/Red Switch         | electronic       |
| b) | GTE/Red Switch          | electronic       |
| c) | 2246A Oscilloscope      | test equipment   |
| d) | 5100B Meter Calibrator  | test equipment   |
| e) | C-21 A                  | aircraft         |
| f) | Front-end Loader        | construction eq. |
| g) | C-20 A                  | aircraft         |
| h) | CID#31 Signal Generator | test equipment   |
| i) | 1/2 Ton Pickup Truck    | vehicle          |
| j) | Snow Blower             | construction eq. |
| k) | Sentinel Bright II      | computer         |
| l) | Scope Shield/LMR        | electronic       |
| m) | CCPDSR                  | computer         |
| n) | Granite Sentry          | computer         |
| o) | PCCIE                   | power equipment  |
| p) | Sentinel-Aspen          | computer         |
| q) | 21 Victor               | computer         |

### Analysis Methodology

The questionnaire was designed to start each interview with generally broad questions that eased the interviewee into more specific areas about their COTS system. Question 1 was designed to get the basic facts about how the system worked, who used it, and where the system was operating. Question 2 sought out to insure that the COTS system was pure COTS or modified COTS. By differentiating the system, the researcher was insuring the interviewee did not provide information on a MIL-SPEC system. If the modification was significant, then the modified COTS system was beginning to fit the qualifications of a developmental system (Sacramento:1).

After the system was identified as being a modified or pure off-the-shelf item, the researcher posed question 3 to identify the maintenance concept to determine if the equipment was to be repaired in-house or by a contractor. The Air Force's maintenance concept uses either in-house personnel and support equipment (organic) or contractors (contractor logistics support, CLS) to repair and maintain COTS systems. Organic maintenance is defined as the in-house capabilities of the Air Force to service the system with current facilities and staffing personnel. Contractor Logistics Support (CLS) is defined as the total maintenance and supply support effort by a vendor for the COTS system. The purpose of question 3 was to identify the special

requirements of contracting out CLS for the COTS system. Organic maintenance capabilities are predictable and governed specifically in the 66 series Air Force Regulations. Whereas CLS may operate under factory authorized instructions. Question 4 followed question 3 to allow the logistician to tell how the maintenance concept affected the mission capability of the COTS system.

Question 5 asked the logistician to discuss in detail how drawings and manuals affected the mission capability of the COTS system. Additional information was needed within this question to further clarify issues that may have had either an adverse impact or significant improvement on the mission of the COTS system. Question 6 was designed to identify whether the COTS system was being used as a stand alone system or as part of another larger system. The researcher also sought to identify critical mission impairments or significant improvements caused by incorporating the COTS system into another system or facility with question 6.

Question 7 addressed the training issues that were required by personnel who operated and supported the COTS system. Question 8 covered the very important issue about the spare parts for the COTS system. Question 9 was a follow-on to question 8 as it linked spare parts to configuration management and control of the COTS system.

Question 10 allowed logisticians to state how they adapted to configuration changes in the COTS system.

Question 11 was designed to be a general question that polled the logistician for support problems that may have impacted the capabilities of the COTS system. Next, the researcher allowed the logistician to use creative thinking to identify changes to improve the COTS system in question 12.

Question 13 was straight forward in that it sought the expert's opinion of whether the Air Force made a good purchase in the specific COTS system. Question 14 allowed the logistician to identify any other features, benefits, or problems that were not previously discussed in the interview. Finally, question 15 addressed specifically how the budget and manpower cuts would affect the COTS system. The results from the final question is extremely important to future Air Force logisticians who must face impinging budget cuts such as in the early 1990s.

### Conclusion

The management styles and techniques were gathered by telephone interview using the questionnaire found in Attachment A. In the next Section IV, the results of the telephone interviews will be described in detail. The data gathered from the questionnaires will be compiled and analyzed for similarities and differences in managing the logistics support for the sampled COTS systems.

## IV. Findings

### Introduction

The following information is the results from the telephone interviews conducted for this research study. The information is presented by individual response for questions 1 through 15. See the methodology section (chapter III) for an explanation of each question and Appendix A for the questions.

### Findings

#### Command Control Switching System (CCSS).

Question 1. The CCSS consists of secure and/or non-secure command and control (C2) digital switches. CCSS will expand secure voice service within the C2 elements of the Air Force (AF) and DoD agencies. The CCSS supports all levels of C2 from base/wing to air division to numbered AF (NAF) to major command (MAJCOM) to commanders-in-chief (CINCs). The CCSSs allow users to talk securely within a protected enclave and to utilize communications security (COMSEC) interfaces to talk to external users. There are 57 AF switches, a total of 154 switches worldwide which include the DoD and civilian sector.

Question 2. Yes. The CCSS was modified for government use to interface with communications security (COMSEC) government furnished equipment (GFE). The interface with the GFE was required to improve the performance of the GFE by reducing crosstalk and to meet TEMPEST requirements.

Question 3. The CCSS will have contractor logistics support (CLS) for the life of the system. There will only be one contractor to support the system (Electrospace Systems Inc.).

Question 4. The maintenance support for the CCSS will be contractor maintained until an organic maintenance capability can be developed. Cost estimates revealed it will be cheaper if we use blue-suit (organic) coverage versus contractor. A large part of the current customer dissatisfaction is being caused by the lack of adequate user training. The logistics manager recommended the contractor provide

training videos to resolve the training problems at all bases that have the CCSS.

Question 5. Commercial manuals for the CCSS will be purchased for each site. Manual changes or revisions resulting from Class I engineering changes shall be submitted to the Air Force for review and approval at least 60 days prior to implementation at any location. The contractor shall submit contractor furnished equipment (CFE) notices that provide information and recommendations to the USAF for selection of manuals required for logistics support of the CCSS equipment. The contractor shall provide monthly schedule and status reports for technical manuals and revisions to be acquired under the contract.

Question 6. Yes. The heart of the AFLC secure voice system is the secure CCSS, commonly called the Red Switch. This is a "secure only" switch, which can be coupled to a "nonsecure only" switch to provide total communications within a facility. The secure switch interfaces with the existing long-haul connectivity such as AUTOSEVOCOM, STU-IIs, STU-IIIs, and provides unlimited secure conferencing. The prime contractor performed the integration. The system's configuration is not unique to the USAF.

Question 7. On the job training (OJT) for the CCSS was considered in the interim contract. The Air Training Command (ATC) will provide resident training (type three) if they are given two years to prepare and if the USAF provides a switch for training use at the USAF school location. Due to the cost of obtaining a switch, it would not be cost effective to task ATC for the training. Therefore, the contractor shall provide factory (type one) training to personnel of Air Force specialty code (AFSC) 306X1 or 362X1. Training will be on-going through the life of the contract. Training shall be commensurate to a five-level (specialist, between apprentice and journeyman level) or equivalent.

Question 8. Yes. The contractor provides the analysis of trends concerning the frequency of line replaceable units (LRUs) and tracks shipments of failed and replacement parts for the CCSS. The contractor provides spare parts in sufficient quantities to sustain equipment performance for 60 days without resupply. If the spare parts provided do not meet the 60 day need, the contractor will be notified and shall adjust the levels to assure a 60 day minimum resupply. The government reserves the right to call a review of the spares level if two or more valid emergency demands occur within 60 days. Under emergency conditions, the contractor shall ship the replacement spare part to arrive at overseas or CONUS locations within 24 hours after receipt of order.

Question 9. Instead of requesting the CCSS contractor to establish a common baseline, the government recommends a baseline with complete justification for each change. The government reserves the right to approve/disapprove the contractor's proposed changes. This gives the government two advantages. First, we govern the baseline and restrain the contractor from proposing a baseline which is over and above the baseline for any/all government CCSS's. Second, the government drastically diminishes or eliminates the need for site surveys and can implement full depot support in a timely fashion. Benefits should result in significant cost savings. Consolidated inputs will determine a baseline for incorporation into the request for proposal (RFP).

Question 10. The CCSS contractor shall provide a configuration management plan for hardware and software. All site specific software configuration items will be identified and described in the version description document applicable to each CCSS installation. A government configuration control board (CCB) will evaluate each Class I engineering change proposal (ECP) for approval or disapproval.

Question 11. No. The CCSS contractor provides shipping containers to the site and is responsible for shipment of spares including vendor equipment both to and from the site. The only facility considerations are the requirements that the switch be located within a protected area (red enclave).

Question 12. Usually COTS are fielded without integrated logistics support (ILS) because ILS slows the process for the program action officer (PAO) to field the system. The manager would not have used logistics support analysis (LSA) procedures to develop full ILS for the system. The PAO no longer uses full ILS for COTS.

Question 13. Yes. An ILS representative must be kept involved in the acquisition management process. The PAO usually takes short cuts and actions necessary to get the system fielded to satisfy the customer requirements within the projected milestone.

Question 14. Yes. Very few communications systems are implemented through research and development (R&D). To implement and develop a new system through R&D utilizing organic support will take five years (providing there are no set backs which could delay the program). Provisioning a communications system is becoming a "by-gone era." The provisioning effort is not cost effective. Just assigning a national stock number (NSN) to a COTS communications system part costs approximately \$2,000. Also the NSN process requires a coordination with a myriad number of government



offices to do many tasks such as getting the item cataloged, registering the USAF as the user, putting the item at a central storage warehouse, determine its shelf life, etc. This tedious process can add as many as 18 to 24 months to the program's development. Technology in the communications equipment arena is moving too rapidly. By the time we get a system fielded, it has become obsolete.

Question 15. Yes. Manpower and budget cuts will affect the supportability of the CCSS program. Currently, the MAJCOMs are being forced to cut manpower in order to meet budget restraints. Since organic maintenance support has proved to be cheaper for this program, the USAF will be forced to go back to more expensive CLS contracts as the manpower cuts begin to affect the mission capability of program. To resolve this conflict in higher expenditures, USAF PAOs should take funds from lower priority programs to assure the best support for mission essential programs like the CCSS.

#### GTE Red Telephone Switching System (RTSS).

Question 1. The RTSS is a telephone switch that supports red (secure) and black (non-secure) command and control telephone systems between commanders and their agencies. It is configured to operate as a black interface and computer interface with voice STU-III/II instruments and black telephones. Also, the RTSS may be used as a teleconferencing between all black or red subscriber equipment. The RTSS is a 1.8 billion dollar USAF program scheduled to be installed at all CINCs, at the National Military Command Center (NMCC), the Alternate NMCC (ANMCC), Joint Chiefs of Staff, MAJCOM command centers in FORCOM, European Command, HQ PACAF, Yokota, and Clark. Fifty percent of the system cost is in logistics support. The contract allows for purchase of as many as 300 switches by FY 1997, and eight are on order for FY 1990 with the first switch scheduled for acceptance testing on 1 July 1990. The RTSS is similar to the AN/TTC-39 mobile switching system.

Question 2. Yes. The RTSS was modified to meet red/black TEMPEST standards and to make GFE adaptive to commercially available components used within the system. A primary concern with integrating the red/black criteria was to determine the vendor personnel who (civilians) could work around special compartmental information (SCI) processing areas. The RTSS is based on the concepts of the AN/TTC-39 switching system, but very little is in common past that point (about 30% commonality exists). However, the RTSS still uses true COTS TEMPEST computers, power supplies, etc.

About 40% of the RTSS is new development. The RTSS required 16 ECPs prior to the initial deliver/installation.

Question 3. The RTSS has several options for logistics support under a two-level concept (organizational and depot): 1) full CLS at the organizational level (40 hour work week with a maximum two hour restoration time after normal duty hours), 2) full CLS at the organizational level (24 hours per day seven day per week with a maximum 20 minute restoration time), or 3) 100% organic USAF logistics support. At the depot level, only GTE maintains the equipment (authorized factory repairs). PACAF will use option one. The three Army switches will convert to option three after the one year warranty ends. Most other USAF and DoD locations will use option two. The manufacturer is prime contractor for the CLS contracts, but this prime contractor subcontracts work out to three other companies for worldwide support. There can be some problems coordinating repairs on hardware between the three subcontractors and the prime contractor.

Question 4. The contract is still too new to discover any advantages or pitfalls. However, the contract was modified to enhance the system expense accounting procedures by going to monthly billing instead of single repair action billing. Also, the contract modification included a provision to allow the contractor to update software, technical manuals, and hardware when required.

Question 5. The commercial manuals are adequate. Once the contract modification takes place, updates to the manuals will be done regularly. The USAF has had some difficulty getting past technical manual problems resolved (two 80% in-progress reports (IPRs), three validation attempts, and final technical order validation rescheduled for July 1990). The USAF does not own the data rights to the engineering drawings or the technical manuals for the RTSS. GTE has agreed to notify the USAF within 180 days of any reprourement rights for the RTSS which may force the USAF to support the system with another CLS vendor (or by using USAF organic capabilities). GTE will charge the USAF fees to reformat technical manuals and to provide copies of extra authorized manuals that exceed the original system manuals which are supplied with the original equipment.

Question 6. Yes. The USAF is charged with interfacing the GTE RTSS with GFE for DoD through special interface equipment. GTE subcontracted the interfacing process. The RTSS is not unique to the USAF because it will be used throughout DoD (except the Navy wants to use their own version). The primary problems with the integration effort were 1) due to the dynamic changes within the COMSEC

equipment and 2) subcontract items did not interface or meet government specifications. The USAF decided the RTSS will be the standardized system to replace older/obsolete systems located within the USAF and DoD to resolve the multitude of interfacing problems with the older systems.

Question 7. The RTSS will have three types of training: 1) contractor sponsored training for government quality evaluators, 2) in-factory training for two years for joint service personnel and civilian users that will revert to an ATC training responsibility (with all training materials from the factory going to USAF trainers), and 3) factory sponsored field training provided once per base with seven weeks of classroom and two weeks of OJT (all subsequent training will be conducted by base personnel for the life of the system). The main problem with training occurred with the first course because there was not an installed system to use as training equipment. USAF students say the training is adequate and the Army students say it is not adequate.

Question 8. Yes. The RTSS has a built-in on-line redundant feature to decrease the chance of downtime due to failure of critical spares. The prime contractor is the sole provider for spare parts for the RTSS program and has a 20 year prepriced schedule for these parts. GTE will place spare parts at strategic shipping locations (to maintain a seven day priority/critical part list to be available at any of the worldwide locations within 24 hours for emergency resupply) after the USAF/DoD contract is negotiated and provided for in the USAF budget.

Question 9. Spare parts could become unique to already delivered RTSSs, and the potential will exist for production spares to be nonfunctional in production systems (if the configuration changes). Hopefully, the production systems will remain operational after configuration changes. The USAF added a clause into the contract to make the prime contractor responsible for spare parts upgrades and to maintain site configuration control.

Question 10. The RTSS has site configuration control clauses built into the contract to protect the USAF/DoD from configuration changes to the system.

Question 11. No. There are no foreseeable problems because GTE is responsible for damages caused by improper packaging, handling, shipping, and transportation (PHS&T) for RTSS parts. The contractor must meet red facility installation criteria and are monitored by government personnel to insure the contractor meets these standards.

Question 12. The USAF should harden the RTSSs against high altitude nuclear electromagnetic pulse radiation blasts (HEMPing). The USAF should also purchase level III engineering drawings up front and fully provision the RTSSs through the USAF/DoD supply system versus buying everything from the prime contractor. Since spares kits can be abused by "stuffing" them full of unnecessary and expensive parts, the government should outlaw their use permanently. Alternatively, government planners should use proven forecasting techniques to preposition parts that are justified against expected system failure rates instead of using blind guesses to "stuff" spares kits.

Question 13. Yes, but it depends upon the program requirements. For example, all black telephone circuits, personal computers, some airline avionics, radios, etc. qualify as pure COTS. The manager questioned any government intentions to call modified systems pure COTS (such as the following two examples: a VAX 8010 computer is COTS but a red telephone switch is not, and an inertial navigational system can be COTS until the government tries to apply design or performance specifications to the purchase contract).

Question 14. Yes. Buying from the lowest bidder could easily result in a lack of worldwide product support. For example, the USAF should buy the name brand leader for personal computers such as the IBM PC instead of a clone from a smaller company. When the smaller company is required to build spares to support the USAF's worldwide mission (coupled with the problem that neither the USAF nor the company owns the design rights to the original PC circuit boards) may force the smaller firm to go out of business. Another problem with COTS systems occurs when the government has to interface the commercial system with MIL-SPEC systems (such as the red switch). The best advantage of buying COTS occurs from the fact that an initial purchase of a particular system sets a precedence for buying additional units in the future through sole source contracts in order to maintain standardization.

Question 15. Yes. Any cuts in the budget will affect the RTSS CLS contract which only costs \$73,000 per year for a PACAF site that has the 40 hour option. Cuts will require the government to either renegotiate the CLS contract at a higher price or to convert to organic logistics support at significant added costs. The manager found through research that for every CLS technician replaced by an USAF organic capability would require four to five USAF technicians (this additional cost would result if the CLS budget were reduced). Since neither money nor additional manpower would be available under cutbacks in the 3400 budget for CLS depot

and site maintenance, the logistics manager would have no choice but to eliminate logistics support for some switches (not possible since this is interfaced with COMSEC equipment).

#### 2246A Oscilloscope.

Question 1. The Tektronix 2246A oscilloscope is a dual trace bench test oscilloscope that has a 100 megahertz bandwidth. The oscilloscope is supported by San Antonio ALC, TX. The oscilloscope replaces 90 older oscilloscopes with different stock numbers. Many commercially available plug-in option boards are available to increase the capabilities of the 2246A oscilloscope. The oscilloscope is used by all operational commands worldwide.

Question 2. No. The 2246A oscilloscope was not modified for government use.

Question 3. Tektronix is the manufacturer of the 2246A oscilloscope who will provide the logistics support with a five year 100% parts and labor warranty. After three years of operation, logistics support could convert to an organic capability at the base PMELs if cost data show an economic savings versus another five year warranty with Tektronix. Limited calibrations and adjustments are still made by base PMELs (limited organizational maintenance only).

Question 4. The factory warranty maintenance concept for the 2246A oscilloscope has improved the overall support for USAF oscilloscopes as well as the advantage enjoyed by replacing 90 older models with only one oscilloscope (the 2246A). Since the system has been in operational use for 18 months, some quality deficiency reports (QDRs) have been initiated at the organizational level. Three week turn around times from the factory for the QDRs has been excellent to date.

Question 5. The commercial manuals for the 2246A oscilloscope are adequate. The manuals were certified by the USAF AGMC standards lab, and a USAF technical order (T.O.) number was assigned to the manuals. A T.O. cover sheet was attached to the front cover of the commercial manuals. All updates to the manuals from the factory are sent to the San Antonio ALC for approval and copying. These approved changes are mailed to organizational units who operate and maintain the oscilloscope. Problems encountered with the oscilloscope are resolved at the San Antonio ALC using engineering change proposals (ECPs).

Question 6. No. The 2246A oscilloscope presented no unusual interfacing problems. The oscilloscope is not unique to the USAF.

Question 7. The 2246A oscilloscope does not require special factory or ATC training. The ATC training at Lowry AFB, CO gives military technicians fundamental training in the maintenance of similar oscilloscopes. USAF civilians must show oscilloscope repair knowledge (as well as other test equipment repair skills) prior to hiring by USAF personnel offices. Currently there are no problems with the training format for the military test equipment technicians.

Question 8. Yes. The vendor provides critical failure parts for the 2246A oscilloscope. There are no spare parts problems.

Question 9. The vendor, Tektronix, must notify the San Antonio ALC for any configuration changes to the 2246A oscilloscope. The configuration has remained operational after configuration changes.

Question 10. Configuration changes to 2246A oscilloscope are governed by clauses in the original acquisition contract.

Question 11. No. There are no PHS&T problems for the Tektronix 2246A oscilloscope.

Question 12. The 2246A oscilloscope does not require any improvements.

Question 13. Yes. The government should have bought more COTS systems a long time ago, and the USAF should definitely continue to buy more COTS items with interchangeable circuit cards (slide-in and slide-out).

Question 14. Yes. Both the USAF and DoD were at a greater disadvantage by using MIL-SPEC systems when ruggedized COTS systems were available to satisfy the mission requirements.

Question 15. Yes, budget and manpower cuts may affect the supportability for the 2246A oscilloscope. During the next three and one half years the oscilloscope will be unaffected by any cuts because it is covered by the factory warranty. There is too much politics concerning the purchase of COTS systems that could jeopardize funding requirements. If funding is discontinued for this system, the USAF will be forced to salvage broken equipment through the Defense Management Reutilization Offices (DMROs) and cut organic funding. The politics and expected cutbacks will prevent the

approval of a waiver to continue the vendor's warrantee for another five years.

#### 5100B Meter Calibrator.

Question 1. The 5100B (Option 3 and Option 5) Fluke meter calibrator is a universal piece of test equipment used by all USAF base Precision Measurement Equipment Laboratories (PMELs) worldwide. The calibrator is used as a secondary standard to calibrate other test equipment used by Air Force technicians at the base level. There are 295 of the calibrators in use.

Question 2. No. The system was not modified for government use.

Question 3. The Fluke 5100B meter calibrator is supported at the organizational level by base PMELs and at the depot level by the Aerospace Ground Meteorological Center (AGMC). The meter calibrator has been 100% organic logistics support since January 1988.

Question 4. The maintenance support has neither improved nor degraded. The Fluke 5100B meter calibrator was too new to see any changes in the maintenance support.

Question 5. The commercial manuals for the Fluke 5100B meter calibrator are adequate. Normal updates to the manuals are handled through the San Antonio ALC. No problems have been encountered with the manuals to date.

Question 6. No. The Fluke 5100B meter calibrator presented no unusual interfacing problems. The meter calibrator is not unique to the USAF.

Question 7. The Fluke 5100B meter calibrator does not require any special training courses by the factory or the ATC. Test equipment technicians use commercial manuals to self-train themselves to repair and maintain the meter calibrator.

Question 8. Yes. The critical failure parts for the Fluke 5100B meter calibrator are adequate. Fluke is the only spare parts manufacturer for the meter calibrator. Some routing delays have occurred in the past, otherwise, the supply support is fine. To alleviate possible problems with spare parts, the spares were included as part of the acquisition contract.

Question 9. The Fluke 5100B meter calibrator does not have any support problems created with the spare parts if

the vendor makes configuration changes. However, the item manager believed the USAF should obtain supplemental data on configuration changes that affect the spare parts in case the USAF consumes all of the spares that were purchased during the initial acquisition.

Question 10. This question is not applicable to the Fluke 5100B meter calibrator.

Question 11. No. Since the Fluke 5100B meter calibrator is a bench top item, there are no facility or PHS&T problems.

Question 12. The Fluke 5100B meter calibrator does not have any logistics support problems.

Question 13. Yes. The government should buy more COTS systems. There were no recommendations for other types of COTS systems.

Question 14. Yes. The USAF should find a better way to track part number changes for COTS systems. COTS systems save time and have proven reliability in the commercial environment because the contractor has done all of the development and set up a spare parts supply network.

Question 15. Yes. Operations and maintenance (O&M) funding cuts may hurt the supportability for the Fluke 5100B meter calibrator, but the universal application allows base PMELs to cross utilize personnel to maintain this system.

#### C-21 Aircraft.

Question 1. The C-21 is a Lear jet Model 35. It seats eight passengers and was purchased to support worldwide transportation requirements for the USAF and the ANG. Its commercial design is for shuttling corporate executives for business travel. There are more Model 35s in use commercially than in the USAF. The USAF bought 78 for HQ MAC, four for the ANG, and one for AFSC. The 83 planes are assigned to 16 bases worldwide. The 78 HQ MAC planes are supported by 100% CLS. The four ANG and one AFSC planes have partial CLS at organizational and intermediate levels.

Question 2. Yes, but the C-21 aircraft are pure COTS except for the GFE black boxes. The maintenance support contract was modified to meet USAF mission capable (MC) rates. The C-21 were also modified to include electronic GFE and USAF painting schemes (to conform to USAF marking schemes).



Question 3. The C-21 aircraft have both CLS and organic organization logistics support. HQ MAC chose to support their aircraft with full CLS, and the ANG and AFSC chose organic logistics support. The depot logistics support is done by the manufacturer (Leer). The forward supply points are supported by contractor operated and maintained base supplies (COMBS) located on or near the flightlines (except the ANG and AFSC, who use an organic forward supply point at the bases where they support C-21s). CLS is done only by Leer and stand alone engineering is done through separate contracts as required.

Question 4. Originally between 83 and 85 C-21 aircraft were leased and later purchased under a contract that required the contractor to keep the aircraft at a fully mission capable (FMC) rate of 85%. To date, the contractor has a FMC rate which exceeds 95%. The contract also includes a liquidated damage clause that allows the USAF to withhold part of the contractor's monthly billing if the 85% FMC rate or USAF supply support standards are not met. The USAF is also adding some military requirements to the system at cost. The aircraft has met or exceeded FAA specifications.

Question 5. The USAF does not own the maintenance manuals for the C-21 aircraft. The USAF does have dash one (flight manuals) T.O.s which are the commercial flight manuals with USAF T.O. cover sheets attached to the front covers. However, the ANG has developed unapproved maintenance manuals (not fully within MIL-SPECS). The Military Airlift Command (HQ MAC) wants fully MIL-SPEC analysis for the dash one T.O. (this will insure that the manuals meet MIL-SPEC standards for training and operation of the aircraft). All changes to the commercial manuals are sent (per terms in the CLS contract) to the Oklahoma City ALC where these changes are copied, stocked, stored, and issued for the organizational units.

Question 6. No. The C-21 aircraft presented no unusual interfacing problems. The C-21 is not unique to the USAF.

Question 7. AFLC does not conduct any training for the C-21 aircraft. HQ MAC conducts training for base/vendor personnel (base personnel consist of quality assessment evaluators (QAEs)) at bases where the C-21s are assigned. The CLS contractor trains in-house for their support people to insure these personnel meet FAA certification standards. The acquisition contract included initial organizational and intermediate maintenance training for CLS and USAF (QAE) personnel and initial FCF (flight operations) training. All requests for additional training for USAF personnel is funded separately from the original acquisition contract.

Question 8. Yes. The contractor supplies critical failure parts for the C-21 aircraft within USAF supply standards, or the contractor faces liquidated damages (a percentage off of the monthly billing for failure to meet the criteria). Since the contractor provides all spares, the USAF does not have to own any spare parts. The USAF looks for the top ten percent failure items that are creating a trend for repetitive replacement. If items are repetitively failing, the USAF may ask the vendor for modifications that will correct the high failure rates.

Question 9. The USAF normally would not force the modification to the C-21 aircraft because the vendor would update the system to his advantage for reasons such as flight safety or cost savings to maintain the aircraft. The vendor can not change the form, fit, or function (F3) of the aircraft without USAF approval because the change could impact the flight safety. If flight safety is affected because a change needed to be implemented, the USAF works with the vendor to issue an immediate time compliance technical order (TCTO). All other changes are negotiated between the vendor and management at the Oklahoma City ALC.

Question 10. TCTOs are issued for flight safety changes to the C-21 aircraft, otherwise configuration changes by the vendor are negotiated with managers at the Oklahoma City ALC.

Question 11. Yes. Pilot seasoning is difficult when flying VIPs. Cleanliness is very important for the C-21 aircraft because it is highly visible by executive level military and civilians. Outside storage of these planes accelerates damage to the externally painted surfaces. Host/base units will not help the contractor meet this need. MAJCOM to MAJCOM agreements get sticky, but the contractor ends up getting the blame for poor appearance when in fact it is the USAF's problem.

Question 12. During the acquisition process, the USAF should stipulate in the statement of need (SON) that the COTS system with CLS should remain in its original form and remain CLS for the life of the system. The USAF should not add MIL-SPEC items or modifications to the system, ask for engineering and technical data, or plan organic logistics support after deciding to buy pure COTS with full CLS.

Question 13. Yes, the USAF should buy more COTS systems with CLS. The USAF is currently pursuing this with the acquisition of the COTS tanker training system (TTTS). Trade-offs have to be made when considering COTS systems for USAF programs. The decision depends on the support requirements, amount of funding available, and manpower. The USAF

should do a feasibility to see if COTS systems can satisfy the program's war essential missions before making the commitment to buy the system as COTS (rather than developmental).

Question 14. Yes. There are both advantages and disadvantages to buying COTS systems for USAF programs that vary depending on the results of the programs' feasibility studies, cost results, and mission support requirements.

Question 15. Yes. If the annual budget is cut for the C-21 aircraft program, the USAF will cut flying hours to minimize CLS and operating expenses.

#### Front-end Loader.

Question 1. The front-end loader is used by the USAF for construction, maintenance, and rapid runway repair at all operational command bases worldwide. Three vendors currently supply the front-end loaders: Komatsu-Dresser, Caterpillar, and Deere-Case. The front-end loader may be ordered to include the following attachments: fork, buckets, and a crane-like boom. The system is mobile and may be transferred from base to base to fill demand requirements, but the system is normally dedicated to a single location. The expected lifespan of the front-end loader is approximately 13 years.

Question 2. The front-end loader is pure COTS. Some minor modifications were required to meet the rigors of northern tier bases near the Arctic Circle (winterization to withstand -40 degrees Fahrenheit). Also, air transportability modifications were made to allow the front-end loader to fit inside USAF transport aircraft (to meet weight distribution, height, and length restrictions). Polyurethane paint was ordered in the contract to prolong damage caused by corrosive environments (e.g. salt spray or application of rock salt).

Question 3. The front-end loader is supported by 100% organic maintenance at base level. Parts are supplied through local parts houses or through the Defense Construction Supply Center (DCSC in Columbus, OH buys commercial parts to support overseas systems where local parts houses are unavailable). Technical data manuals are available.

Question 4. The maintenance support concept for the front-end loader has neither improved nor upgraded since initial acquisition of the system. The only drawback to the

system may be the numerous system configurations available from the various manufacturers.

Question 5. The factory technical manuals are complete and adequate to support the front-end loader. Changes are posted only when the factory prints service bulletins. The USAF does not have any access to the engineering data.

Question 6. No. The front-end loader presented no unusual interfacing problems. The front-end loader is not unique to the USAF.

Question 7. The front-end loader did not have initial training included as part of the acquisition contract. ATC provides training in the initial heavy equipment training course for USAF military personnel. Otherwise, other USAF personnel are trained at the base level through an OJT program. No problems have occurred to date with the current training format.

Question 8. Yes. Standardized parts are readily available either on the local economy or through DCSC for the front-end loader. Normally there are no delays to obtain repair parts whether bases buy on the local economy or through DCSC.

Question 9. If the manufacturer changes the front-end loader's configuration, spare parts will change, but the configuration change will have a minimal impact on the USAF because we do not stock the repair parts. Normally, if there are configuration changes for this type of equipment, the core design remains static. The best feature of this system is its commonality with other heavy construction equipment (which is another reason why configuration changes will have only minimal impacts on the front-end loader). The primary problem encountered by the USAF is that only small quantity buys are made. Thus interchangeable parts become less frequent between front-end loaders over a period of several years. The Warner-Robins ALC attempts to identify the common parts between systems (such as hydraulic o-rings, filters, and noses) to minimize the problems that are created by the small quantity buys.

Question 10. The USAF has attempted to deal with configuration changes by identifying common parts from year to year for the front-end loaders.

Question 11. Yes. The front-end loader requires a drop-bed trailer for highway transportation and has no unusual requirements when using rail transportation. The front-end loader must use either heated hangars or outside

heaters for northern tier bases during the winter season. To meet intra-command demands for the front-end loaders when equipment shortages exist, MAJCOMs coordinate these moves through the Warner-Robins program office that supports all loaders worldwide.

Question 12. The USAF should make larger economy buys for the front-end loaders to allow standardization, interchangeability of parts, and economies of scale.

Question 13. The manager was not sure because there is always a shortfall when considering buying front-end loaders. More COTS should be bought where possible. COTS can not always be used for every application such as combat missions.

Question 14. Yes. The advantages of buying COTS are that the product is already developed and the USAF does not have to wait for R&D efforts. The disadvantages may occur when the USAF is forced to compromise mission accomplishment, parts may not always be available, and the government manager must strike a balance between too much or too little support to stay within the program's budget while satisfying mission capability (a "no-win" situation).

Question 15. Yes. New front-end loaders are only funded for 30% of the requirements. Additional budget cuts will result in more backlogs. This backlog will increase maintenance costs because the USAF will have to keep and maintain the older front-end loaders for longer periods.

#### C-20 Aircraft.

Question 1. The C-20 is a Gulfstream III aircraft. It seats 14 passengers and was purchased to support worldwide transportation requirements for the USAF, very important persons special air missions (VIPSAM), the Navy, and the Army. The USAF bought ten for HQ MAC to provide shuttle service between Andrews AFB and Ramstein AFB FRG, three for VIPSAM, two for the Navy, and two for the Army. The 17 planes are supported by 100% CLS. All planes except the two Army aircraft have contractor depot support.

Question 2. Yes. The C-20 aircraft was modified to meet military configuration requirements to include electronic GFE and painting. The main modifications were in the communications equipment.

Question 3. The C-20 aircraft are supported by 100% CLS from the manufacturer and several subcontractors for the life of the system.

Question 4. The C-20 aircraft has performed very well to meet mission requirements.

Question 5. The USAF does not own or maintain any technical data for the C-20 aircraft. The USAF will have to buy the technical data if the USAF modifies the aircraft. The contract legally binds the CLS contractor (manufacturer) to supply technical data to different CLS contractors (non-manufacturer) who are awarded the CLS contract for the aircraft.

Question 6. Yes. The USAF had to buy additional flightline aerospace ground equipment (AGE) to support C-20 aircraft for Andrews AFB and Ramstein AB FRG. The C-20 is not unique to the USAF because it is commercially available and two other government agencies use it.

Question 7. Training for pilots who fly the C-20 aircraft is provided by the factory. Factory technical representatives are kept at Andrews AFB and at Ramstein AB FRG to provide partial maintenance and training for CLS personnel. No problems have occurred to date with the current training format.

Question 8. Yes. CLS personnel for the C-20 aircraft have easy access to the contractor operated and maintained base supply (COMBS, owned by the USAF). The CLS vendor maintains the COMBS and must meet supply demand requirements based on the contract requirements.

Question 9. The configuration management for the C-20 aircraft was built into the statement of work (SOW). The CLS vendor/manufacturer keeps the aircraft systems current.

Question 10. The configuration changes for the C-20 aircraft are controlled by the SOW.

Question 11. No. The C-20 aircraft is not experiencing any problems with facilities or PHS&T.

Question 12. No changes were recommended for any of the logistics support procedures for the C-20 aircraft.

Question 13. Yes. The USAF should buy more of the C-20 aircraft. Other programs that could possibly use COTS systems must be evaluated on a case-by-case basis depending on the need and requirements of the program.

Question 14. No opinion was given for disadvantages/advantages to consider when buying other COTS systems.

Question 15. Yes. Budget and manpower cuts for the C-20 aircraft will require the USAF to cut flying hours to stay within the budget constraints.

Programmable Synthesized Signal Generator.

Question 1. The programmable synthesized signal generator is test equipment that may be supplied by any vendor who can satisfy the commercial item description 31 (CID 31) at the San Antonio ALC. The signal generator operates with a frequency range from 2 to 26 gigahertz. CID 31 was intended to replace many older signal generators that had much narrower frequency bandwidths and to allow more competitive buying practices. The signal generator supports aircraft electronic maintenance shops, logistics support shops, and common support equipment at 20 to 30 USAF MAJCOMs and DoD activities worldwide.

Question 2. Yes. The programmable synthesized signal generator was modified to meet the DoD requirements for faster rise times and the frequency range for pulse modulation testing applications. The modifications were made by the vendor by changing electronic circuit cards within the signal generator to meet the DoD requirements.

Question 3. The programmable synthesized signal generator is maintained 100% organic logistics support at the organizational/base PMELs. Ninety-nine percent of the depot level is done by organic logistics support at the base PMELs. The remaining one percent logistics support are sent back to the factory for repair and calibration during manpower or testing facility shortages.

Question 4. The maintenance support for the programmable synthesized signal generator improved because the USAF consolidated support from many signal generators into this single national stock number item.

Question 5. The programmable synthesized signal generator comes with commercial manuals. The commercial manuals are adequate. No changes have been made to the signal generators to date, but any future changes will be reviewed by managers at the San Antonio ALC and subsequently sent to organizational units who own the signal generators.

Question 6. Yes. Some integration was required to replace 20 to 25 year old equipment. A government engineer developed the requirements for the programmable synthesized signal generator to replace older equipment. The configuration is not unique to the USAF.

Question 7. Only the USAF engineer and USAF equipment specialist assigned at the San Antonio ALC (SA-ALC) received factory training for the programmable synthesized signal generator. Base level support personnel are using the commercial training manuals and the support from the SA-ALC engineer and equipment specialist to maintain the signal generator. The current method of training is adequate and has not created any problems to support the signal generator.

Question 8. Yes. The programmable synthesized signal generator is a new system, and there are no problems with critical spare parts availability. The USAF has purchased many parts based on factory failure estimates and USAF item management policy.

Question 9. The contract for the programmable synthesized signal generator has provisions that require the contractor to notify the USAF (in writing) of configuration changes that may affect spare parts. The USAF will make adjustments to spares based on the degree of the change made by the factory.

Question 10. The programmable synthesized signal generator configuration control was addressed during meetings and negotiations between the manufacturer and USAF managers (when changes negatively impact the USAF).

Question 11. No. The programmable synthesized signal generator is a benchtop item that does not have any PHS&T or facility problems.

Question 12. The USAF has too much bureaucracy that prevents buying additional programmable synthesized signal generators (as well as other automatic test equipment (ATE)) to have on the warehouse shelf. Having the ATE on the warehouse shelves will allow the ALC to be more responsive to organizational requirements. The current process requires organizational units to state their need for test equipment, budget and wait on Congress for approval, and wait even longer while the ATE is purchased from the vendor. This process may take more than two years to complete.

Question 13. Yes. The USAF should buy more programmable synthesized signal generators. Also, procurement of COTS equipment depends on USAF minimum data requirements. The USAF must ensure commercial units meet the minimum requirements of a program before proceeding further with the acquisition plans.

Question 14. Yes. The two main advantages of buying COTS systems are: 1) COTS systems are easier to buy and 2) these systems are already developed by industry.



Question 15. Yes. Budget cuts will prevent buying additional programmable synthesized signal generators. The reverse situation is also important. If the government required many of these systems during a war surge, vendors could not setup their manufacturing processes to keep up with demand.

#### Half-ton Pickup Truck.

Question 1. The half-ton (nicknamed "four by two") pickup truck is a general purpose vehicle that is purchased from five vendors: Chevrolet, Dodge, Ford, GMC, and International. Approximately 50,000 half-ton pickup trucks are assigned to every USAF base worldwide.

Question 2. The half-ton pickup truck was not modified for government use. The USAF purchased the economy package (without air conditioning nor radio) and either USAF "Strata Blue" or with military camouflage paint.

Question 3. The half-ton pickup truck is 100% organizational organic logistics support. There is no depot logistics support because the life of the system and its replacement costs do not warrant rebuilding the trucks to "like-new" condition. After a predetermined number of years and/or miles occur, the trucks are salvaged and replaced with newer models.

Question 4. The maintenance support for the half-ton pickup truck has been done completely by base support personnel since 1983. Since 1983, bids have been made by base personnel and local vendors on a year-by-year basis to get the least expensive parts and labor costs. Overall the USAF has not had any significant problems with vendors who won the contracts. To ease maintenance support, the USAF mobile communications units and the base support motorpools are given the flexibility to order parts from their local economies. In isolated overseas areas, USAF units must buy parts directly from the factory when parts are not available on their local economies.

Question 5. One copy of the factory operator's, repair, and parts manuals are supplied with each half ton pickup truck. Occasionally, manuals are not shipped with every vehicle, but, since most bases get more than one of these trucks, there are plenty of technical manuals to support the trucks. The Warner-Robins ALC assigns 36 series T.O. numbers to the factory manuals and ships extra manuals to organizations who are shorted by the manufacturers.

Question 6. No. The half-ton pickup truck presented no unusual interfacing problems except the additional DLD (computerized diagnostic) test stands that were purchased to replace the Sun diagnostic centers. The DLDs were necessary to support the automotive computers installed in Chrysler and GM model pickup trucks. The primary concern was to get the DLDs prepositioned before the manufacturer's warrantee ended.

Question 7. The half-ton pickup truck does not require any special factory training. Military personnel receive initial automotive maintenance skills through the ATC fundamental vehicle maintenance repair course. USAF civilians must be experienced automotive mechanics to qualify to work in USAF motorpools. The current training format is adequate, and there are no training problems.

Question 8. During safety recalls by the manufacturer of the half-ton pickup trucks, the manufacturer furnishes parts and labor in the CONUS and parts overseas. Some delays occur within PACAF and USAFE because vehicles move around frequently. To resolve these delays, HQ PACAF/USAFE has put a liaison office at Warner-Robins ALC. The liaison office has a computerized tracking database system for all vehicles assigned to the two commands (installed and operational since 1985). The new computer system enhanced the older manual efforts by reducing the location time from months to days. The computer system also resulted in getting safety recalls installed sooner to reduce the risk of accidents.

Question 9. The half-ton pickup truck parts are made by the manufacturers for ten years (by U.S. law). Most manufacturers have gone ahead to make parts for 20 years. The USAF does not stock parts for each model year of pickup truck. The commercial market place demands yearly configuration changes. The USAF salvages the trucks after the system has met mileage or about ten years of service requirements and is replaced with a new model.

Question 10. Since the half-ton pickup trucks are replaced about every ten years and parts are readily available, configuration changes to the trucks have the same impact as other types of COTS systems.

Question 11. Yes. The half-ton pickup trucks going overseas require special corrosion treatment (to reduce the effects of sea spray). Truck transportation to CONUS bases frequently dent the exterior surfaces, and USAF personnel accept faulty products by prematurely signing the DD 250 acceptance form. Warner-Robins ALC has advised organizational

units to make more thorough inspections to prevent acceptance of faulty trucks.

Question 12. The half-ton pickup truck was engineered to last and has a proven track record for superior technology. There is little else to say to complement these COTS items.

Question 13. It is hard to say. The USAF bought sufficient quantities of half-ton pickup trucks to support operational requirements. However, the USAF should include Japanese trucks in the product mix because of their proven dependability record. The Japanese Toyota pickup truck surpasses many American made pickup trucks manufactured over the last 25 years. No comments were made about buying other types of COTS systems.

Question 14. Yes. An advantage of buying COTS for many government agencies at a central agency (such as the at the General Services Administration (GSA) and at U.S. Army TACOM for vehicles) are the economies of scale. A disadvantage of buying COTS pickups are the higher costs charged by the manufacturer for the custom colors (eight to ten percent higher for Strata Blue and camouflage paint).

Question 15. Yes. Budget cuts have already placed a moratorium on buying new general purpose vehicles (which includes the half ton pickup trucks) for FYs 1991 and 1992. The moratorium does not apply towards special purpose vehicles. Any future budget cuts will require the USAF to cut order quantities.

#### Snow Blower.

Question 1. The snow blower is a multi-purpose vehicle with two plow attachments, and blower and cutter heads. The snow blower was awarded its initial contract in June 1989. The 600 to 700 snow blowers that will be acquired by USAF will support northern tier bases for HQ SAC, PACAF, the Alaskan Air Command, USAFE, and ANG bases in the CONUS.

Question 2. No. The system was not modified for government use. The only government requirement was the "commerciality clause" that was included in the request for proposal (RFP). The snow blower had to be available in the commercial marketplace for 12 months before the USAF could buy for USAF's applications. This clause protects the USAF from the possibility of a lack of spare parts because the system is not established in the commercial market place.

Question 3. The snow blower will receive organic logistics support at the organizational level and CLS at the depot level. The bases will do some yearly standardized repairs under the "Summer Rebuild Program." Normally, only limited technical inspections will be accomplished by the base to determine whether to send the snow blowers back to the factory for repairs. The parts are supplied by contractor operated parts supplies both in the CONUS and overseas contractor operated parts stores.

Question 4. The maintenance support for the old snow blowers have experienced some problems due to the systems' age. No major acquisition has been made since the early 1960s. The oldest system is 52 years old. Some snow blowers were remanufactured three or four times. Now the aging fleet is experiencing metal fatigue (similar to old military aircraft air frames). The 300 new multi-purpose snow blowers will greatly improve the maintenance support for these older systems.

Question 5. The snow blower will use factory commercial manuals. The USAF is waiting on the final analysis report on these manuals by USAF personnel. The system is in the preliminary stages of the critical design review. The USAF expects to receive updates regularly based on information in the program document (PD).

Question 6. No. The snow blower presented no unusual interface problems. The snow blower is unique to the USAF, but commercial firms such as Emery Air Freight and Federal Express have shown some interest in buying the exact same model. There is a provision in the acquisition contract to deal with unique kits for special applications.

Question 7. The acquisition contract obligates the contractor to provide maintenance training to USAF personnel on the snow blower in the future. The commercial technical data is expected to be self-explanatory to USAF vehicle maintenance personnel. It is too early to determine if the training will be sufficient.

Question 8. Yes. Critical failure parts will be easily accessible for the snow blower. Contractor operated parts stores will supply spares in the CONUS and overseas (COPARS and COPAS). No delays are expected because of the proven track record of the COPARS and COPAS operations.

Question 9. No configuration changes are expected because the snow blower will be commercially unique.

Question 10. Configuration changes to the snow blower will be accomplished manually at the Warner-Robins ALC. The

contract requires engineering changes to be approved by the USAF prior to implementation.

Question 11. No. There are no PHS&T problems with the snow blower because the system is too new.

Question 12. The USAF should simplify the acquisition process for the snow blower by limiting the organization to use only the advertised functional attachments. With the snow blower, the USAF permitted the RFP to add attachments not offered in the vendor's commercially available model.

Question 13. Yes. The USAF should buying more snow blowers. Other COTS systems should be evaluated to stay within budget constraints when replacing older systems.

Question 14. Yes. Several advantages when buy COTS include economies of scale, ease of support, ease of purchase, and readily available parts. No comment was made about disadvantages when buying COTS.

Question 15. Yes. However, manpower cuts at the organizational level that supports the snow blower can adapt more easily than other USAF organizations can with budget cuts.

#### Sentinel-Bright II Computer System.

Question 1. The Sentinel-Bright II intelligence training system uses several commercially available types of hardware and software components that will interface with COMSEC GFE at Goodfellow AFB TX. The system will support the USAF and other DoD activities.

Question 2. Yes. Substantial portions of the Sentinel-Bright II system are COTS hardware and software. The remaining portions are COMSEC GFE. The contractor is dealing with the TEMPEST requirements to change and interface the existing COTS hardware and software into the GFE.

Question 3. The Sentinel-Bright II will only have CLS at the organizational and intermediate levels. The CLS contract will last five years from the initial operational date. There is potential for more than one hardware and software contractor, but the USAF would normally like singular management by one contractor (the software CLS contract will be awarded in FY 91). The CLS contract gives the contractor the freedom to remove broken parts and send to a local/intermediate repair facility.

Question 4. The Sentinel-Bright II computer system is too new to assess the maintenance support concept.

Question 5. The Sentinel-Bright II computer system uses a combination of MIL-SPEC drawings with commercial technical data. The USAF will give the CLS contractor the flexibility to upgrade the commercial data and to update commercial drawings/manuals as required. The USAF is trying something new and innovative with this Sentinel-Bright II system. Technical interfacing data will be extracted from magnetic media similar to CAD/CAM software programs to update changes to the system. To resolve design problems with the interfacing of MIL-SPEC systems to the COTS equipment, the USAF had detailed design reviews with the contractor. Magnetic media (such as floppy disks) were used to resolve compatibility problems.

Question 6. Yes. The Sentinel-Bright II computer system was integrated into COMSEC GFE and into a specially built TEMPEST building at Goodfellow AFB TX. The prime contractor did the interfacing work. The system is unique to the USAF, but the system could be expanded to train other DoD/civilian personnel at other schools. The primary integration problems occurred with the TEMPEST issues and how to determine what type of installation standards to use (MIL-SPEC or ANSI/commercial).

Question 7. Training for the Sentinel-Bright II computer system will be provided by the vendor to a government cadre. Then, the government cadre will provide training to other government personnel. It is too early to determine if the training will be sufficient.

Question 8. Yes. MIL-SPEC parts for the Sentinel-Bright II computer system may cause more problems than the COTS parts. The commercial parts support will be placed at the mercy of the prime contractor. There is potential for some delays in getting parts because the system is still in development.

Question 9. The Sentinel-Bright II computer system will have a minimal investment in spares. So, configuration changes will have little impact on spares for the system. The USAF has several choices to go to different suppliers to satisfy equipment requirements. To alleviate problems with equipment availability, the USAF may substitute some common equipment like video displays, computers, or disk drives. Some minor problems in the software need fine tuning by the contractor.

Question 10. The USAF uses a support group to closely monitor the installation and development of the Sentinel-

Bright II computer system. There is some flexibility to go to multiple suppliers. Engineering drawings are clear and keep the configuration controlled mutually between the contractor and the USAF.

Question 11. Yes. The Sentinel-Bright II computer system required special facilities to be built to house the system. The system was built from scratch to support over 400 student positions to be located within the facility. No other PHS&T problems have been encountered to date.

Question 12. The USAF should have developed the technical manuals for the Sentinel-Bright II computer system earlier (it took two to three years to get them from the start of the program). Otherwise, the system is too new to make additional recommendations.

Question 13. Yes. Buying COTS equipment to interface with GFE for the Sentinel-Bright II computer system sped up the buying process. If the system contained pure COTS, the USAF could not meet all of the military needs of the training system.

Question 14. Yes. The primary advantage of buying COTS systems is that it speeds fielding USAF programs. The principle disadvantage of buying COTS equipment happens when the USAF compromises performance standards to interface COTS into government developed systems. When this compromising occurs by tailoring the overall system to government specifications, the USAF will get less performance than what is needed.

Question 15. Yes. Budget cuts will affect the availability of the Sentinel-Bright II computer system. CLS is set up to support numerous systems, and the CLS is spread across many programs. So the budget cuts will not be felt nearly as hard as if the CLS contractor was just supporting this program.

#### Scope Shield Land Mobile Radio System.

Question 1. The Scope Shield Land Mobile Radio (LMR) system provides ultra-high frequency (UHF) two-way communications for USAF, ANG, and USAFR security police forces assigned to Weapon Systems Security and Base Ground Defense missions in deployed wartime missions. Over 4000 radios were purchased from Magnavox to provide the worldwide mission. The radio uses a multiple band frequency hopping technique to foil enemy electronic jamming. The radios may be modified for encryption by using plug-in KY crypto chips.

The encryption will provide additional operation security for the security police forces.

Question 2. No. The Scope Shield LMR was developed solely by the vendor to meet their perception of what would be a marketable UHF hand held (portable) radio. Magnavox's military version has some features which would not be needed by commercial users. So, the commercial version is designed to have less functions than its military counterpart. Currently Magnavox has not sold the radio to the public.

Question 3. The Scope Shield LMR does not use CLS at the organizational level. At the organizational level, the radios are repaired organically by removing and replacing (R&R) modular components. If the repair action is beyond the technical capability of the organizational unit, the radio is sent to the factory for depot overhaul/repair. Magnavox maintains 100% factory CLS for depot overhauls/repairs because they maintain special depot test equipment, manuals, and supplies.

Question 4. The Scope Shield LMRs' source of repair (S&R) was made late relative to the availability of the operational radios. The production contract did not include resources for depot activation. The system program office (SPO) assumed the program would be using total organizational CLS. However, Sacramento ALC elected to use organic logistics support. The depot spares, technical manuals, and support equipment were late as a result from this mix up in the decision for logistics support. Some delays to field additional radios were caused by the additional lead time required to modify the contract to buy depot spares. This initial problem resulted in fielding some radios without full logistics support while the integrated logistics support (ILS) resources were being negotiated.

Question 5. Commercial technical manuals are adequate for the Scope Shield LMR equipment. Proprietary rights reside with the vendor, therefore, the manuals are not part of a reprourement package. The manuals get updated only if the equipment is upgraded by the USAF or by the original equipment manufacturer (OEM) (no one can get the changes due to the contractual agreements). The biggest problem with the manuals is their coverage of the LRU spares. The spares are bought sole source because of the proprietary rights granted to the original vendor. Any future changes to the equipment for the LRU spares will also require increasing the sole source funding to change the manuals at all worldwide locations.

Question 6. Yes. The Scope Shield LMR was integrated into USAF security police vehicles for mobile applications.



The USAF base motorpools had no problems fabricating installation kits to use the portable radios in security police vehicles. The radio is unique to the USAF, but the U.S. Army is considering buying some of the next version of this radio (phase II).

Question 7. The Scope Shield LMR uses on-the-job training (OJT) at the organizational level for USAF security police personnel. The training is simple because the radios are user friendly. Currently, there are no problems with the training.

Question 8. Yes. The critical failure parts for Scope Shield LMRs are located at the organizational level. The USAF provisioned organizational spares to fill the initial supply support levels (ISSLs) and war reserve material (WRM) requirements. When the program began fielding initial units, contractual problems arose concerning organizational spares that resulted in delivery of radios to units without spares. The leadtime to provision the spares was greater than the production time for the radios. Some streamlining for provisioning the line replaceable units (LRUs, modular components) had to be done in weeks rather than the normal lead time of 12 to 18 months.

Question 9. The spare parts will not impact the configuration control for the Scope Shield LMRs. Since the USAF is the main (only) customer for the LMRs, the next generation of equipment is significant enough that this first generation LMR will not get any enhancements that will change its original configuration.

Question 10. The Scope Shield LMR has not had any configuration changes. USAF managers are not expecting any configuration changes because the next generation radio based on this model is totally changed such that the USAF model can not be modified to receive the new enhancements.

Question 11. No. The Scope Shield LMR does not have any PHS&T problems nor any facility problems. The radios are rugged portable units designed for outside use by security police.

Question 12. The Scope Shield LMR experienced some program errors at the USAF SPO because of oversight. Depot spares should have been provisioned in the initial contract. The SPO learned their lesson and have included the depot provisioning process in newer contracts.

Question 13. No. The USAF should have waited to buy the next generation model. The next generation is being qualified now. The USAF should buy COTS systems for other

programs that use equipment such as computers because they can be applied to any mission with creative approaches.

Question 14. Yes. The main advantage of buying COTS is to get the latest technology cheap and fast. The government can plan to replace COTS more frequently because we will not have to spend a lot of research and development money. COTS has a disadvantage because the USAF may falsely assume investment money will be available because the USAF will save money in another appropriation's R&D which is not feasible. The support system for COTS needs to be innovative and flexible. Phase provisioning such as high speed provisioning of LRUs and depot parts is needed. Stronger consideration should be given to CLS to reduce investment costs and the time to set up support (to allow economical analyses to be performed). USAF personnel need to get used to using more COTS type manuals and training. During the acquisition phase, life cycle system management for COTS must give more consideration to the potential users and supporters.

Question 15. No. Budget and manpower cuts will not affect the logistics support for Scope Shield LMRs.

#### CCPDS-R (Replacement) Computer System.

Question 1. The CCPDS Replacement (CCPDS-R) computer system is replacing the missile warning computers and consoles in Cheyenne Mountain AFB, the worldwide display terminals (WDTs) at 24 worldwide locations for commander in chief (CINC) assessments, and the SAC force management/Force Survival subsystems at Offutt AFB, NE. Users include USSPACECOM, SAC, CINCEUR, CINCPAC, Office of the Joint Chiefs of Staff (OJCS), CINCLANT, and Canada. The equipment is pure COTS except for the consoles that were fabricated to hold the equipment. The system includes COTS software and approximately one million lines of ADA computer code.

Question 2. No. The CCPDS-R computer system contains pure COTS hardware and software except the consoles to hold the equipment.

Question 3. The CCPDS-R computer system is vendor supported at the depot level through the vendor's facilities. The USAF maintains the equipment with organic logistics support at the organizational level.

Question 4. Much of the equipment the CCPDS-R will be replacing has become insupportable due to its long service life, and because the vendors will (can) no longer support it. So, AFLC was forced to perform limited reverse

engineering or seek alternative equipment if possible. By using the CCPDS-R COTS equipment, the overall maintenance support concept will improve for this system.

Question 5. The CCPDS-R computer system uses commercial manuals to the maximum extent. Drawings for the COTS equipment are considered to be under level II source control. The commercial drawings are adequate for all users of the system except the AFLC support activities. The drawings are adequate and in accordance with the contractor's specifications, but the AFLC air logistics center (ALC) is asking for specification control drawings for the COTS equipments. The largest problem with this additional requirement is that the USAF will not provide the funding to buy the extra drawings. The drawings are updated by the vendor through updated microfiche. Ninety-five percent of the commercial manuals for the CCPDS-R use microfiche.

Question 6. Yes. The CCPDS-R computer system was integrated into other systems inside the Cheyenne Mountain Complex (CMC), Offutt AFB, and the regional CINCs' command centers. The primary interfacing effort focused on installing the new system into preexisting facilities. The prime contractor installed the CCPDS-R based on information supplied by the government and other contractors. The system is uniquely configured for the USAF, but the equipment is not unique to the USAF. No problems have been encountered with the integration effort.

Question 7. System training for the CCPDS-R computer system will be developed by the prime contractor. By integrating existing commercial information about the system's hardware and software, the contractor will provide training to system maintenance personnel, system security staff, and combat crew operators. The training will be essential to keep the system operational. The training contract has not begun development yet, therefore, it is too early to determine if the training will be sufficient.

Question 8. Yes. The critical failure parts for the CCPDS-R computer system will be easily accessible at the organizational level. The spare parts will be purchased through commercial vendors by AFLC. There are no problems to date caused by critical failure parts.

Question 9. Until the USAF configuration control boards (CCBs) approve the change, there is the possibility that hardware (i.e. unapproved circuit boards) could be shipped to the field by the vendor. There is very little guidance for disposition/modification instructions concerning the spares that become obsolete as a result of a

configuration change. There has not been any configuration changes made to the system to date.

Question 10. The CCPDS-R computer system has not experienced any configuration changes, but all configurational changes must be approved by the configuration control boards (CCBs).

Question 11. No. The CCPDS-R computer system does not have any PHS&T problems nor any facility problems.

Question 12. The USAF should freeze the baseline for spares for the CCPDS-R computer system. By freezing the baseline, the USAF could prevent configuration changes from occurring that would otherwise make spares useless. Also, the vendors should be required to ship preapproved revisions for newer configurations to the USAF before payment is made. This procedure would prevent the vendor from updating the equipment without the consent of the USAF and to prevent "dumping" of parts.

Question 13. Yes. The advantages of buying COTS certainly outweigh the disadvantages. The advertised advantages of buying COTS negate the impacts of constant configuration changes by the COTS vendor. COTS is useful for most applications, but ruggedization is a major concern.

Question 14. Yes. The primary advantages of buying COTS are shorter acquisition time and existing commercial basis for support.

Question 15. Yes. Manpower cuts for the CCPDS-R computer system may not have much impact because the USAF is already having trouble filling positions in the initial training classes for the system's USAF technicians and operators. Budget cuts and reallocations have already impacted the program twice by slipping the completion time. Additional budget cuts will slip the completion time even further.

#### Granite Sentry Computer System.

Question 1. The Granite Sentry computer system is completely COTS. It replaces older stand alone computer systems at the Cheyenne Mountain Complex (CMC) for CONUS air defense that became obsolete in 1988. The Granite Sentry computer system is also a part of an integrated defense system that supports USSPACECOM, Peterson AFB, and the CMC.

Question 2. Yes. The Granite Sentry computer system will replace all of the 427M systems at the CMC by 1995.

The system is a combination of COTS equipment purchased from Digital Equipment Corporation (DEC). The USAF will coordinate subsequent actions to integrate the equipment and software into the CMC as a government air defense system. Some of the software is being modified at USSPACECOM by USAF programming personnel for use in the system.

Question 3. The Granite Sentry computer system currently uses organic logistics support at the organizational level and interim contractor support (ICS) for depot level repairs to maintain the system through April 1991. Depot CLS/ICS will keep the system operational from April 1991 until date of the program management requirements turnover (PMRT, the transfer of the program from AFSC to AFLC and the operational command). The CLS contractor will replace all faulty LRUs and system replaceable units (SRUs). Currently, Digital Equipment Corporation repairs all parts that fail within the manufacturer's 90 day warrantee. Lockheed performs the depot level repairs under a three year CLS contract that has options for renewal. The initial CLS depot contract being recommended by the ILSM could revert to the manufacturer DEC at PMRT.

Question 4. Since the system is brand new, there is no change in the maintenance support concept. The ICS, organic logistics support, and factory warrantee is adequate.

Question 5. The Granite Sentry computer system uses commercial manuals. The systems manuals are being evaluated for USAF technical order specifications, otherwise, all other manuals will remain commercial. The commercial manuals are adequate. The commercial manuals are updated through a yearly subscription service. There are no significant problems with the commercial manuals.

Question 6. Yes. The Granite Sentry computer system is being installed in phases. Phase one has been completed (replacing the 427M workstations). The modernization program required no major modifications to existing equipment. The hardware is not unique to the USAF, but the software is. The USAF is performing the integration/installation effort. The commercially standardized equipment and software helped integrate the program easily into the USAF's preexisting equipment.

Question 7. Training for the Granite Sentry computer system will be developed and provided by the vendor (SDAS Corp.). The vendor will train all USAF operations personnel, initial maintenance cadre staff, and USSPACECOM training staff. The USSPACECOM training staff will provide all follow-on operations training after the initial vendor training ends. Digital Equipment Corporation agreed to

contracting terms to train 23 maintenance personnel for one year for \$150,000 plus government temporary duty traveling expenses. The follow-on maintenance training could transfer to a ATC classroom or by contract (to be determined).

Question 8. Yes. The critical failure parts for the Granite Sentry computer system are easily accessible. Until 1995, the parts will be leased from the vendor by the CLS contractor. Any future CLS contractors will also lease the critical spares from the equipment vendor. To alleviate possible shortfalls with spares, AFLC will do some provisioning by 1993 before PMRT.

Question 9. The impact of configuration changes on spares for the Granite Sentry computer system is dependent upon the degree of the revision for the configuration change. In some cases, the USAF gets revisions that are normally cycled with the repair actions. The system definitely remains operational after these changes occur. No problems have occurred to date.

Question 10. The configuration changes that are made to the Granite Sentry computer system are thoroughly tested in-house by USAF technical staff to validate the change. When USAF personnel are satisfied that the configuration change will not degrade the mission, the change may be implemented throughout the system.

Question 11. No. The Granite Sentry computer system does not have any PHS&T problems. The vendor (DEC) transported the new equipment to our USAF sites and installed the system into our existing facilities. No problems were encountered.

Question 12. The USAF should get a prime contractor for systems like the Granite Sentry computer system. There were no problems with the COTS equipment, rather, it was USAF rules and the mind-set thinking about how we develop programs through the USAF bureaucracy. As a result of this way of doing business, programs like Granite Sentry are more expensive because we try to get the program to progress like the fully developed format. The USAF needs newer rules and definitions to handle COTS through AFLC and Sacramento ALC's Technical Data Division. With systems as large as Granite Sentry, it may not be cost effective to continue going with COTS until these changes are implemented.

Question 13. Yes. The USAF should buy more of these COTS systems. However, the largest concern is the USAF's need for a uniform support structure for dealing with COTS systems and equipment. The USAF should buy other types of

COTS equipment such as electronic video equipment because it could use similar contracts developed for COTS computers.

Question 14. Yes. The main disadvantage is the USAF's non-uniform treatment of COTS systems. The USAF at AFLC and the Sacramento ALC Technical Data Division have too many people who are trained to treat COTS systems like fully developed systems. This treatment slows down the acquisition process to the point where it may not be cost effective to use COTS when the process takes as long as fully developed systems.

Question 15. Yes. Since the Granite Sentry computer system is being implemented in phases, the USAF can end the program early if manpower and budget cuts are significant. Otherwise, larger budget cuts will have detrimental impacts on the supportability for the parts of the system that have already become operational.

#### Power Conditioning and Continuation Interfacing Equipment.

Question 1. The Power Conditioning and Continuation Interfacing Equipment (PCCIE) is covered by two five year requirements contracts for power conditioners with Liebert corporation and uninterruptible power supplies with Exide Electronics. There are 75 models ranging in power ranges from 1 to 1000 KVA (kilo-volt-amperes, a rating of 1000 watts continuous power). There was no concept development (Full Scale Development, FSD) phases because the equipment had been on the commercial market (and tested) for a number of years. All MAJCOMs use the PCCIE as well as other government agencies and services. Our equipment has been installed at most USAF bases. The contract is 1.5 years old and all systems are still covered by the two year factory warrantee. The initial PCCIE contract for acquisition and support exceeds \$620 million.

Question 2. No. The PCCIE was not modified for government use.

Question 3. The PCCIE has depot CLS planned for the life of the equipment. The system has only minor organic support requirements at the organizational level. If the system requires significant repairs, the item is removed and sent to the CLS depot (which is covered by a five year contract that will be recompeted every five years).

Question 4. The PCCIE has a better maintenance support concept than prior generations of equipment because maintenance support was included on the contract as an optional line item. The maintenance line item includes

maintenance training and emergency maintenance for the PCCIE.

Question 5. The PCCIE contract offers the operating user technical manuals as a line item (optional selection with the equipment order). The commercial manuals are adequate. Technical manual changes are sent by the manufacturer to the owning organizations. The USAF has not had any problems to date with the commercial manuals.

Question 6. Yes. The PCCIE is part of the power quality system. PCCIE has to be integrated into existing computer systems in pre-existing facilities. Also PCCIE has to be connected into generator systems. The CLS contractor and the government perform the installation and integration. However, the full installation and integration is a line item option on the contract to allow 100% contractor installation. When the 100% contractor installation is selected, the USAF must still certify and accept the installation with one of the USAF's QAE personnel. The equipment configuration is not unique to the USAF. No major problems have been encountered to date with the systems' integration into existing facilities and government owned equipment.

Question 7. Maintenance training for the PCCIE is provided by the contractor to USAF and government personnel who need it. The training is a line item option that is selected by the operational base to avoid a yearly maintenance contract with a CLS contractor. The training is adequate, and there are no problems to date.

Question 8. Yes. The critical failure parts for the PCCIE have been provisioned (Liebert 100% and Exide is being provisioned) and stock listed by the USAF. Currently the contract is too new to detect any problems with support for these parts. Organizational users also have spares kits located as forward supply points with the PCCIE. The PCCIE has been on the market so long that USAF managers do not expect the equipment to change much. However, the contract includes wording to expand the number of line items to include improved models when they become available.

Question 9. The PCCIE has not experienced any configuration changes to date.

Question 10. The PCCIE has been on the commercial market for a long time. The USAF included wording on the contract to allow improved models to expand the number of line items on the contract. The additional expansion capability allows government managers to buy state of the art equipment as soon as it becomes available.



Question 11. Yes. The PCCIE has had some packaging failures and transportation has slowed down the installation process. The contractor had to replace damaged items because he was liable for damages to the new equipment before delivery to the installation sites. The transportation problems centered around redirect orders (RDOs) which the USAF resolved by having USAF transportation offices research the delays to make recommendations for further improvements.

Question 12. No response was made for this question.

Question 13. Yes. The systems have been extremely reliable and have filled a critical gap in the USAF power equipment inventory. The USAF should buy more COTS only if the systems have had a history of success in the commercial market.

Question 14. No response was made for this question.

Question 15. No and yes. The PCCIE will not have any problems due to budget or manpower cuts except the number of additional units the government plans to field/buy in the future.

#### Sentinel-Aspen I Computer System.

Question 1. The Sentinel-Aspen I computer system will only be used in one location at Goodfellow AFB TX to modernize intelligence training equipment for the Air Training Command (ATC).

Question 2. Yes. The Sentinel-Aspen I computer system is nearly 100% COTS hardware. Only six to seven circuit cards were modified for unique government requirements. Some of the software was developed for specific training applications. All other software was COTS.

Question 3. The Sentinel-Aspen I computer system is covered by a one year CLS contract with four one year options. When the Sentinel-Aspen I system is completed, the contract will be awarded for five years and will be renegotiated every five years thereafter. All Sentinel COTS systems' hardware (including Sentinel-Aspen's) are covered by a single CLS contractor. The software for the Sentinel systems is covered by another CLS contractor. Conflicts (occurring from problems in the system) between the hardware and software contractors are resolved through the government site representative (a government computer specialist from the local USAF communications squadron).

Question 4. The Sentinel-Aspen I computer system has not had any maintenance support problems with the CLS.

Question 5. The USAF did not purchase any equipment drawings for the Sentinel-Aspen I computer system. The CLS contract requires the software contractor to subscribe to a microfiche commercial manual service from the equipment vendor (DEC). The CLS contract also requires the hardware contractor to use LRU diagnostics in the system and product equipment manuals (required to be purchased and maintained by the contractor at his cost). When neither contractor can resolve complex equipment/software problems, the contract requires the contractor to contact the original equipment manufacturer (OEM) to solve the problems at the contractors' expense. The contractors are required to maintain the system at a 95% effectiveness rate with the available technical data. If the effectiveness rate falls below the 95% rate, the contract allows the government to withhold a percentage of the contractors' monthly billing as a penalty. The CLS contractor may also have to maintain and stock spares to meet the 95% rate.

Question 6. Yes. The Sentinel-Aspen I computer system was integrated into a government facility. The government facility was designed and built to hold the Sentinel-Aspen I system. Some interfacing is on-going with other Sentinel intelligence training systems. The government civil facility engineers did the site preparations because it was cheaper than contracting out this requirement. System architecture was done by an installation contractor different than either CLS contractor or the original equipment manufacturer (OEM). The Sentinel-Aspen I system is a unique system to the USAF, but the equipment is not. No significant problems were encountered during and after the integration efforts.

Question 7. CLS personnel were required to be trained before the USAF awarded the contract to the CLS contractor. If the OEM or USAF make future enhancements to the Sentinel-Aspen I computer system, training will be provided to the CLS contractor on a reimbursement basis.

Question 8. The critical failure parts are easily accessible for the Sentinel-Aspen I computer system. DEC (the OEM) wanted to win the hardware CLS contract, but DEC's bid was significantly more expensive than the current CLS contractor. DEC lost the CLS contract, and refused to supply the parts to the CLS contractor for repairs on the Sentinel-Aspen I system. The CLS contractor was forced to pay more for parts by going to a third party vendor. However, the USAF will only pay the CLS contractor GSA list price for the spares. The CLS vendor may ask the USAF to resolve the

dispute with DEC to lower the cost of repair parts. The USAF will cooperate because the contract binds the USAF to resolve disputes like this. Some parts are no longer made for the system. It will be the CLS contractor's problem to seek form, fit, and functional replacements to the system to keep it operational. If significant problems result from the unavailable parts, the USAF will have to determine replacement or substitution policy on a case by case basis.

Question 9. The Sentinel-Aspen I computer contract puts problems with configuration changes on the CLS contractors. Configuration changes must be approved by USAF configuration control boards through engineering change proposals (ECPs). The system must stay operational during configuration changes. No configurations were made to the system during the last six months (since its operation began).

Question 10. The Sentinel-Aspen I computer system has not had any configuration changes since the beginning (during the last six months). Future work-arounds by the CLS contractor and USAF managers will be required on a case-by-case basis if the system's configuration changes.

Question 11. No. The Sentinel-Aspen I computer system has not had any major PHS&T or facility problems since its installation began.

Question 12. The USAF should have bought the equipment drawings and other suitable data for the modified COTS equipment. Program funding was not available to buy this data in the original acquisition. The long term impact on the system could lead to early obsolescence or difficulty when recompeting the CLS contract. However, even if sufficient funding had been available, the OEM may have refused to release the proprietary information on the modified COTS equipment.

Question 13. Yes. The USAF should buy more computer equipment like the Sentinel-Aspen I. COTS are suitable for certain applications such as the intelligence equipment training mission of the Sentinel systems. COTS should only be used depending upon proposed program's mission and application (not suitable for combat type applications).

Question 14. Yes. The primary advantage of using COTS in USAF system requirements occur when the USAF can incorporate available technology into the new programs. The primary disadvantage to the USAF is that COTS should not be used for combat use.

Question 15. No and yes. The Sentinel-Aspen I computer system will not have problems with manpower cuts because it is using a CLS contract. Limiting budget requirements for the Sentinel-Aspen I system will possibly limit upgrades and parts acquisitions by the CLS contractor which may ultimately affect the mission effectiveness of the intelligence training system.

21 Victor Intelligence Data Handling System, Computer.

Question 1. The 21 Victor system is also known as the AN/GYQ-21(V) Intelligence Data Handling System. It provides support for DoD intelligence services and agencies at 130 plus locations worldwide.

Question 2. No. The 21 Victor system has not been modified for government use.

Question 3. The 21 Victor system has used 100% CLS since 1976. The contract requires the prime contractor (no subcontractors are involved) to maintain the system at a 95% effectiveness level per month. When system problems exceed the contractor's capability, the contract allows for outside technical support from the OEM. Currently, no depot support exists for the 21 Victor system, but the follow-on CLS contract may include CLS depot support. Past CLS contracts only lasted five years, but the next follow-on CLS contract will last ten years.

Question 4. The maintenance support system has improved since 1976 because the CLS contractor's personnel have increased their experience and skill level. If government site representatives determine that engineering personnel do not keep the equipment at the 95% effectiveness level, the CLS contractor will receive maintenance credits against their monthly billing. These credits are monetary penalties based on percentage points below the 95% effectiveness level stated in the CLS contract.

Question 5. When the 21 Victor system was delivered, the CLS contractor received the equipment/site documents to maintain the system. Since the initial delivery, the USAF has taken a hands-off approach to stay apprised with the site specific drawings for the 21 Victor system. When prospective contractors have wanted more information about the technical data in order to bid on the CLS contract, the USAF has given prospective CLS contractors ample time to view the site drawings. Then, the prospective contractors can include any update costs in their competitive bids for the five year CLS contract. Since the USAF does not plan any system modifications, the USAF does not have any use for

equipment/site drawings. However, the requires the CLS contractor to provide data and logs for site specific repair actions (through the government site inspectors).

Question 6. Yes. The 21 Victor system is a stand alone system. The biggest challenge to the government was to install the COTS equipment into SCI facilities. The original system was installed by contract and government personnel. The system has been integrated with government communications networks since the original installation. The system is not strictly the USAF's nor DoD's. The logistics manager was not working this system originally, but he has information that describes a smooth installation.

Question 7. The CLS contract for the 21 Victor system does not provide for initial formal training for CLS personnel. If the USAF enhances the system, the CLS contractor will be asked if they can support the enhancements. If the contractor agrees to the changes, the USAF will pay the contract personnel to attend the manufacturer's school. The training is adequate.

Question 8. Yes. The USAF does not dictate to the CLS contractor how to stock spares for the 21 Victor system. The 95% effectiveness level requirement has caused the CLS contractor to stock some spares, but the USAF does not get involved in determining the stock levels.

Question 9. Configuration control for the 21 Victor system is the CLS contractor's problem. The USAF only pays for the upgrades/enhancements to the equipment. Ultimately, the contractor makes the choice whether they will install the enhancements or upgrades to the system.

Question 10. The CLS contractor for the 21 Victor system is required to pay for a subscription service from the OEM for equipment upgrades/enhancements. The USAF allows the CLS contractor to choose these configuration changes as an optional requirement of the contract.

Question 11. No. The 21 Victor system does not have any specific or general PHS&T/facility problems.

Question 12. The 21 Victor system has seen the proliferation of its use in local area networks (LANs) and wide area networks (WANs) during the last few years. Since 1984, the USAF has used an on-site maintenance concept to support the system, but proliferation of the system into more LANs and WANs has created some peculiar support problems. Some equipment is installed at remote locations as part of the network connections. If a contract person abandons the main system while correcting remote problems, he may not be able

to keep the main system at the 95% effectiveness rate (such as when the main system breaks during the travel to/from the remote location). The USAF can not enforce the 95% effectiveness rate for this type of situation when there is only one technician at the main site and many multiple sites. So, the USAF is considering a central site/remote location maintenance concept to be added to the next CLS contract. The provision would allow more funding for more site personnel when additional remote equipment is added, or the USAF would use a suspension rule for the effectiveness rate while one person site personnel are away working on remote equipment.

Question 13. Yes. The USAF should buy additional equipment for the 21 Victor system. The Defense Intelligence Agency (DIA) recently released a new five year contract to buy more equipment. The government is getting smarter by taking advantage of commercially available systems that use proven technology. The government does not have to keep up with the drawings or engineering designs. Since the technology is advancing rapidly, the government is better off buying COTS systems because the "red-tape" to acquire developed systems takes too much time. Buying COTS allows the government to enjoy savings of many economies of scale.

Question 14. Yes. The primary advantage of buying COTS is the savings to the government because they do not have to design the system when it is available on the market. It is not an intelligent choice to design when the system is proven on the open market place. Another advantage of buying and supporting COTS is using one CLS contract to support five DoD agencies. By having a single chair person to resolve support problems, the government enjoys the added benefits of reduced administrative (logistics management support) costs.

Question 15. Yes and not sure. Converting the program to organic support would be disastrous because the government could not replicate the experience level or the system knowledge of the CLS personnel (especially with system's age taken in consideration). The USAF is just beginning to feel the effects of budget cuts for the 21 Victor system. It is too early to tell if these cuts will be adverse to the mission of the 21 Victor system. Some cut-backs in other programs (such as the decommissioning of the SR-71 aircraft) have reduced the impact of budget cuts.

## Conclusion

The material just presented the results from the telephone interviews with the managers who support 17 USAF COTS systems. Next, Section V will analyze these results.

## V. Analysis

### Introduction

This section presents the analyses of the telephone interview results found in Section IV. First, the interview response data will be presented for each question. Second, analysis of the responses to the 15 questions will be compared and contrasted to show the trends of logistics support for the COTS items in this thesis. Again, the reader is reminded the results of this study may not be applied to every type of COTS systems (as discussed in Section III). Third, this section will end with a conclusion.

### Interview Response Data

Of the 18 logistics managers contacted, 17 participated in this research study to make the response rate 94%. Using Emory's suggestion of one contact call plus three follow-up calls, this research thesis exceeded the 85% target for personal interviews by nine percent (Emory:165). Originally, all 18 managers agreed to participate during the first telephone contact call, but one manager could not participate because he was assigned to temporary duty during the research effort. At least three telephone contacts were made with each manager to establish the date and time of the interview.

All managers received an advanced copy of the questionnaire found in Appendix A. The advanced copies were



distributed as follows: 14 were mailed, one was personally delivered to a manager who attended a course at the Air Force Institute of Technology (School of Systems and Logistics), and three were sent by fax machine.

The managers were told in contact calls and in the introduction to the interview that the interview would take approximately 30 minutes of their time. All managers were given ample time to answer each question. Three interviews lasted 30 minutes or less, one interview went past 40 minutes, and the remaining 13 interviews lasted between 30 and 40 minutes. The interviewer needed to probe managers about some questions to prevent non-responses. Non-responses to the questions resulted from either the managers' lack of knowledge, or the system did not have the features or enough operating time to develop usable information. Only two managers indicated they had too little experience to answer all of the questions.

Sixteen of the 17 managers wanted to read the follow-up results of this research study. See Section VI for comments about further research and recommendations regarding the managers' interest in logistics management for COTS systems.

#### Analysis of Question Responses

Analysis of the responses from Section IV will be discussed below. The question design was discussed in Section III. Comparison and contrast for each question will be used

in this analysis to focus on the investigative questions found in Section I.

Question 1: Describe your COTS system, what does it support, who uses it, and name the bases that use it.

Seventeen COTS programs were studied in this thesis. The equipment descriptions follow:

1. Three programs were electronic stand alone systems (two were fixed plant and one mobile/portable).
2. Three programs were test, diagnostic, and measurement equipment (all were portable).
3. Five programs were stand alone computer systems (all were fixed plant).
4. One program was power conditioning equipment (fixed plant) in support of computer systems.
5. Two programs were mobile construction equipment.
6. One program was a general purpose vehicle.
7. Two programs were aircraft.

Hence, 12 of the 15 COTS programs were related to electronic systems. Three of the remaining five programs were related to land or air transportation equipment. The final two programs were vehicular construction equipment.

All 17 programs supported the USAF. Each programs' support level will be discussed below:

1. One program supported worldwide missions from the CINCs down to base level for the NMCC, alternate NMCC, DoD, and USAF.
2. One program supported worldwide missions at the CINCs' level for the DoD and USAF.
3. One program supported worldwide missions from the CINCs down to base level for the DoD and USAF.

4. One program supported missions between a CONUS base and an European Command base at the CINCs' level for the DoD and USAF.

5. Two programs supported missions at two or less CONUS locations for the DoD and USAF CINCs.

6. Three programs supported worldwide missions at the base level for the DoD and USAF.

7. One program supported missions at one CONUS location for the DoD and USAF.

8. Seven programs supported worldwide missions at the base level for the USAF.

In summary, one program supported missions higher than the DoD, nine programs supported missions for the DoD and USAF, and seven programs supported missions only for the USAF. Thirteen of the 17 programs supported worldwide missions, and four supported CONUS missions.

Question 2: Has this COTS system been modified for government use, or is the system pure COTS purchased from the vendor as-is just like the civilian sector? If you answered yes, how is the system modified? Only eight of the 17 programs qualified as pure COTS. However, four of these eight required some work by the USAF to acquire operational systems as follows:

1. One system did not exist on the open market, but the USAF's request for proposal (RFP) generated a commercial version that fit the USAF's mission requirements.

2. One system was a ruggedized product built to withstand government standards and only sold to the USAF.

3. One system required the contractor to build a special console to meet USAF standards, but the form, fit, and function (FF) of the system remained original.

4. One system required customized software development by USAF personnel to make the hardware fit the USAF's mission requirements.

The remaining nine COTS systems were modified for various reasons described below:

1. Two aircraft systems required modified paint schemes and communications equipment (GFE) to be added to meet USAF standards.

a. One plane program required the CLS contractor to modify the recommended OEM's maintenance standards to meet USAF standards).

2. Three electronic COTS systems required some modifications to interface DoD/USAF COMSEC equipment and to meet TEMPEST standards.

3. Two other electronic COTS systems required slide-in circuit card modifications to meet higher DoD/USAF technical standards than the standards used in the commercial market place.

4. Two vehicular systems required USAF paint schemes.

a. One required height reductions to fit inside USAF transport aircraft.

In summary, four of the 17 COTS programs were bought strictly off the shelf. The remaining 13 programs were modified (either by the USAF or the contractor/vendor) to meet security, facility, or technical government standards.

Question 3: How is the COTS system supported: CLS (organizational, intermediate, or depot), or organic (organizational, intermediate, or depot)? If the COTS system is supported by CLS, is the CLS planned for the life of the system, or is the CLS subject to competitive negotiation at specific intervals? Is there more than one CLS contractor

for the system? If so, are there any discrepancies as to which contractor maintains/repairs the item(s)?

One of the 17 programs gave the user the option to choose between total CLS at the organizational level with full CLS factory/depot support from the OEM, or the user could use organic support at the organizational level along with the CLS depot support. The remaining 16 programs fit neatly into the five types of logistics support listed below:

1. Eight programs (including the first program mentioned above) used organizational organic logistics support with factory/depot CLS.
2. Four programs (including the first program mentioned above) used CLS for both organizational and depot levels.
3. Three programs used 100% organic logistics support without depot support.
4. Two programs used 100% CLS at the organizational level without depot support.
5. One program used organic logistics support for both organizational and depot levels.

Thirteen of the 17 programs used some type of CLS contract. The length of the CLS contracts are described below:

1. Two organizational and depot CLS contracts lasted for the life of the systems.
  - a. One contract will convert to organic organizational logistics support with CLS depot support as soon as possible.
2. One organizational and depot CLS contract was pre-priced for 20 years.
3. One organizational and depot CLS contract lasted one year with a four year option and was being scheduled for a five year follow-on CLS contract.

4. Two organizational CLS contracts (without depot level support) lasted for five years (one will use a follow-on ten year CLS contract with its prime contractor).

5. The remaining seven programs used CLS depot contracts with organizational organic logistics support for the life of the systems.

In summary, only two of the 13 CLS contracts had more than one CLS contractor per program. One program used separate hardware and software vendors. The USAF required the contractors to resolve their problems/disagreements through government site representatives. The other program used a single prime contractor for CLS, but the prime contractor used subcontractors to perform the maintenance on the system at multiple locations. No problems have been encountered to date because the contract imposes monetary penalties on the prime contractor if they do not meet USAF mission capable rates.

Question 4: How did the maintenance support concept degrade or improve for the COTS system? What steps were required to resolve any problems? Only one program had degraded contract maintenance, and the USAF was pursuing organic maintenance and training to cut costs and improve customer satisfaction. Maintenance support for the remaining 16 programs are described below:

1. Six systems were too new to assess the maintenance support concept.

a. One of these programs was expected to improve because monthly cost accounting procedures were being instituted, and a provision was being added

to the contract to permit the contractor to update any part of the system when required.

2. Two programs will improve their maintenance support concept because the new equipment is replacing older/obsolete equipment.

3. Eight programs significantly improved their maintenance concept for two reasons.

a. The most frequent reason for improvement resulted from contract language that required the contractor/vendor to maintain the equipment at high levels of effectiveness (such as 85% or 95%).

b. The second reason maintenance support improved for a COTS program occurred because the COTS system usually replaced many older/obsolete systems that had become insupportable.

In summary, too many systems were too new to allow the researcher to make conclusions about whether the maintenance support concept for these programs had either improved or degraded. However, only one in eleven of the programs with responses had a degradation in maintenance support. Thus, a positive trend in the maintenance support was noted for COTS programs. See Section VI for recommendations for further study.

Question 5: Discuss the role of commercial (or military type) drawings/manuals for the COTS system. Are they adequate? Do they get updated as changes are made to the equipment? What steps were required to resolve any problems? Technical manuals for the 17 COTS systems are described below:

1. All 17 programs used commercial technical manuals. Fifteen of the systems' commercial manuals were considered adequate.

2. Two COTS systems were undergoing the formal USAF review process for their commercial manuals.

Updates for commercial manuals were either sent directly to the user/CLS contractor from the factory/vendor, or the updates were shipped to the ALC that supported the COTS program. When updates to commercial manual are sent to the ALCs, the changes are reviewed, copied, stocked, and mailed to users/CLS contractors.

Drawings and engineering data rights are discussed below:

1. Three programs had some engineering data for their equipment. The engineering data was site specific installation drawings that showed interfacing between GFE and COTS equipment.

2. Three programs (all were electronic test equipment) had no comments about the data rights to engineering drawings (but from the researcher's experience with electronic test equipment, engineering data for most test equipment is proprietary information).

Other forms of control used by the USAF to maintain system integrity are:

1. One contract required the vendor to notify the USAF within 180 days for reprourement data (such as an offer to buy proprietary drawings if the vendor would go out of business).

2. One contract required the vendor to notify the USAF within 60 days of class I engineering change proposals to the system (this gave the USAF the ability to stop automatic configuration changes that did not have USAF consent).

3. Other contracts put the burden of maintaining current technical data entirely on the CLS contractor.

4. Several contracts require either software or CLS (hardware) contractors to subscribe or buy into an updating service from the OEM.



Question 6: Was it necessary to integrate the COTS system into any other pre-existing systems or facilities? Who performed the integration (prime contractor, CLS contractor, or the government)? Is the configuration unique to the Air Force? What problems were encountered during and after the integration, and how were they resolved? Only five of the 17 programs were not integrated into other pre-existing systems or facilities. The integration efforts for the remaining 12 programs are described below:

1. Four programs used the prime contractor (one used a subcontractor) to perform the integration effort.
2. Eight programs were integrated by the USAF/government personnel (two with contractor help and one with the CLS contractor's help).

Only five of the COTS programs were unique to the USAF. Three of those five were unique systems using common off the shelf equipment. The three systems were uniquely configured to meet USAF requirements that were not used commercially. The other two programs, unique to the USAF, had commercial derivatives, but the models used by the USAF had not been sold in the commercial market.

Eight of the 17 programs encountered significant integration problems described below:

1. Four programs required interfacing with COMSEC GFE and government facilities.
2. One program was delayed because the subcontractor did not meet the government's TEMPEST installation standards (the installation had to be reworked).
3. Two programs required special support equipment to maintain their systems at USAF bases:

- a. One required a special test stand.
  - b. The other required additional power carts on the flightline.
4. One program required special plug-in circuit cards to allow the system to meet DoD/USAF standards.

Question 7. What type of training format is required?

Who provides it? Who receives it? Is it necessary? Is it adequate? Are there any problems with the training?

Training for the 17 programs is listed below:

1. Seven programs used only on the job training (OJT) for government operations and maintenance (O&M) personnel (except one that gave the system engineer and equipment specialist factory training).
2. Two programs did not require any training format because the CLS contractor was required to use qualified personnel to support these systems. However, the USAF will pay the CLS contractors to send CLS personnel to factory training if enhancements are added to the system.
3. Five programs used a variety of training methods at various stages of the programs' development. Each of the five programs used different combinations of factory and USAF government training formats for USAF/DoD and CLS personnel. However, all five programs used vendor provided factory training when the program was initiated.
  - a. Two programs will be converting the O&M training to an organic USAF capability.
  - b. Three programs will rely on vendor/CLS training because mockups for classroom training were not funded in the initial contracts.
4. Three programs used vendor or contract training formats for government O&M personnel.
  - a. One used OJT for the interim contract to bridge training until the formal factory training was in place.
  - b. One program was too new to assess the effectiveness of the training. This newness trend

affected two of the seven programs mentioned above that were using formal training formats.

c. One program had no significant problems with this training.

In summary, seven programs used OJT training, and ten programs used formal training formats. Seven of the ten programs that used formal training were adequate, and the remaining three programs were too new to evaluate the adequacy of the training. Five of the seven programs (that had adequate formal training) used a variety of training formats during the programs' development to give the USAF greatest flexibility to keep qualified CLS and USAF O&M personnel available.

Question 8: Are critical failure parts easily accessible for the COTS system? Who provides the spare parts? Are there any delays or problems in getting the parts needed to keep the system operational? What steps were required to resolve any problems? The critical spares supplier for the 17 programs are described below:

1. Eleven programs obtained critical spares from the vendor or CLS contractor.

- a. One of the eleven programs also had some provisioning for organic support (from overseas remote locations or an option that was chosen by the user) included with the vendor/contractor supplied parts.

2. Six COTs programs used government provisioned parts supply functions.

- a. Two of the government provisioned programs used contractor operated parts stores.

b. One of the government provisioned programs allowed either organic or contract maintenance personnel to have access to the spares.

c. The other three government provisioned programs stocked spares for users to meet expected failure rates.

The delays or problems for the 17 programs are discussed below:

1. Twelve programs did not have any delays or problems with critical spares.

2. Two programs were too new when fielded and experienced routing delays (one required the USAF to speed up the provisioning process to prevent impacts on the users' mission).

3. One program also experienced routing delays because equipment was too mobile and difficult to track in overseas locations. The MAJCOM worked with the ALC to create a liaison office and install a computer tracking system to reduce the routing delays for critical spares and time compliance technical orders (TCTOs).

4. One program also experienced routing delays, but no recommendations were mentioned to correct this problem.

5. One program experienced problems with maintaining the original form, fit, and function (F3) of the system. Some parts for this system were no longer manufactured or available to the CLS contractor. The CLS contractor had to submit F3 changes to the USAF for review and approval before substituting critical failure parts.

In summary, all 17 programs had easy access to critical spares. Twelve of the 17 programs' spares were supplied by the vendor/CLS contractor, and five programs' spares were supplied by the USAF. Only five programs experienced any major delays or problems with these critical spares.

Question 9: Describe how the configuration management control is impacted by spare parts for the COTS system.

What impact is created when the configuration of the COTS system changes? Does the system remain operational after the configuration changes? What steps were required to resolve any problems? All 17 COTS systems will remain operational if configuration changes occur. If configuration changes occur, minimal or no impact on spares will occur for 14 of the 17 COTS systems. Seven of the 14 programs controlled configuration changes by using contract requirements (usually requiring the contractor/vendor to submit engineering change proposals to USAF configuration control boards for approval). The other seven of 14 programs are described below:

1. Two programs, that have had little or no impact on their spares, had no comments about resolving past configuration problems.
2. Two programs, that have had little or no impact on their spares, had core designs that remained static after the vendor made configuration changes.
3. Three programs with little impact on their spares dealt with configuration changes as follows:
  - a. The USAF obtained supplemental data for the affected spares.
  - b. The USAF depended on the market for spares and will salvage/replace the system after ten years of use.
  - c. The USAF will obtain substitute common equipment if the configuration changes affect the operation of the older equipment (no spare parts are stocked by the USAF).

The remaining three of the 17 COTS programs controlled configuration changes by using contract requirements (these contracts usually required the contractor/vendor to submit

engineering change proposals to USAF configuration control boards for approval). The three programs are described below:

1. One program was too new to assess the impact of configuration changes on the spares, but the CLS contractor was fully responsible for maintaining the critical spares at his expense.
2. One program would adjust USAF spares according to the degree of the configuration change.
3. One program required the CLS contractor to assume all responsibility for upgrades and site configuration control, but potential production spares could become nonfunctional if the configuration changes are extreme.

In summary, ten of the 17 programs include contract language that gave the USAF configuration control (through configuration control boards, CCBs) for these systems. Only two managers had no comments concerning procedures for dealing with configuration change problems in their programs. The USAF will replace the COTS system every ten years for one program to deal with configuration changes.

Question 10: Describe how your staff has adapted to any configuration changes with the COTS system. What steps were required to resolve any problems? Eleven of the 17 programs used contracts to adapt to configuration changes. The contracts for these eleven programs will give the USAF the ability to reject configuration changes (except when related to safety modifications). Adaptations to configuration changes for the other six programs are described below:

1. Two programs are not expected to have any configuration changes. So, this question did not apply.

2. The USAF adapted two programs by matching common parts between yearly models.

a. One program will replace its systems when they are ten years old (because spares and support costs increase significantly after ten years).

b. One program will buy small quantities every year. So, the ALC must cross reference spare parts between yearly models to simplify repairs on older models.

3. Two programs adapt to configurations changes as follows:

a. The USAF will test all changes before buying and installing the changes into every system.

b. The USAF will allow the two vendors to add new models as line items to the acquisition contract (this allows the users to replace older models that become insupportable to age or extreme configuration changes.

Question 11: Does your COTS system have any support problems due to improper packaging, handling, storage, and transportation? Facilities? Other? Ten of the 17 programs did not have any problems with PHS&T or with facilities (one of the programs was too new to assess this question). The remaining seven programs are described below:

1. Three programs only had facility problems to support these COTS systems. These programs required special TEMPEST approved facilities to be built to house the systems. The contractor was responsible for all damages to these three systems that was caused by PHS&T.

2. Four programs had multiple PHS&T, facility, and other support problems as follows:

a. One program had a storage problem which accelerated wear to the systems' painted surfaces. The system also had a problem with giving all of the systems' operators experience because the systems required only the best operators (primarily

because this system supported DoD and USAF executives).

b. One program required drop-bed trailers to transport the system between operating locations, and it required special heaters or heated facilities to store the system during the winter season.

c. One program frequently experienced transportation damage that USAF personnel fail to detect during the initial inspection. The program also required systems going overseas by sealift to receive anti-corrosion treatments.

d. One program experienced occasional packaging failures during transportation from the factory. The USAF required the contractor to pay all damages. The program also experienced transportation delays from redirect orders (RDOs) by the shipping company. The USAF resolved this problem through the USAF's transportation office at the ALC.

Question 12: If you could change anything about the system, what would you like to do to improve the logistics support for the COTS system? Five of the 17 managers did not make any recommended improvements for their programs.

Recommendations for the remaining 12 managers are below:

1. Two managers would have fully provisioned their COTS systems (one would have used installation criteria for high altitude electromagnetic pulse (HEMP) protection, purchased level III engineering drawings, and outlawed spares kits).

2. Two managers also made recommendations to improve the provisioning process for their programs.

a. One manager recommended complete provisioning before fielding the equipment (which included depot provisioning when using organizational organic logistics support).

b. One manager recommended freezing the spares baseline during the provisioning process to allow the USAF to maintain configuration control over the COTS system.



3. Two managers recommended that once the USAF committed the program to COTS, no modifications should be allowed to meet special requirements.

a. One manager was emphatic that once CLS was chosen, the USAF should not change to organic logistics support or buy proprietary data, technical manuals, or spares.

b. The other manager wanted a streamlined acquisition process for buying pure COTS.

4. One manager also wanted a way to speed the acquisition/provisioning process. However, this manager would have used a prime contractor for large integrated systems.

5. Two managers recommended buying larger quantities of COTS systems for their programs.

a. One manager felt the USAF could not get economies of scale from smaller buys.

b. One manager wanted the USAF to buy ahead to fill customer demands rather than forcing the customer to wait two years to get authorization and budgeting procedures accomplished.

6. Two managers made recommendations about the drawings and technical data for their programs.

a. One manager advised buying technical manuals as early as possible when integrating large COTS systems into MIL-SPEC equipment.

b. One manager recommended including the funding to buy type III engineering drawings (if the OEM will sell them) when the USAF buys modified COTS.

7. One manager recommended updating the CLS contract when the COTS system is expanded beyond the original installation site. The update to the CLS contract would add CLS personnel or relax the effectiveness rate if the main system broke while a CLS service person was working at a remote site.

In summary, five managers made no recommendations.

Three managers recommended improving the acquisition/provisioning process for their COTS programs. Two managers

recommend fully provisioning their COTS programs. Two managers recommended keeping pure COTS with CLS. Two managers recommended buying larger quantities of COTS systems for their programs. Two managers made recommendations about the drawings and technical data for their programs. One manager recommended updating the CLS contract when the COTS system is expanded beyond the original installation site.

Question 13: Would you recommend buying more of these COTS systems if you knew what you know now, and why or why not? Would you recommend COTS for other systems? What type and why? Only one manager had unfavorable recommendations for buying additional COTS units in his program. The manager said the USAF should have waited to buy the next generation COTS model from the vendor because the newer model had more enhancements than the original model. One of the remaining 16 managers was not sure if the USAF should buy additional units for his program because the USAF always had a budget shortfall that prevented buying in sufficient quantities to allow savings from economies of scale.

The remaining 14 managers recommended buying additional units for their COTS programs. Seven of these managers did not explain why they would buy additional units. However, the following seven managers explained their reasoning as follows:

1. Keep the ILS representative active throughout the acquisition process.

2. Only buy additional units depending on the level of modifications made to the COTS system.
3. The Air Force should include Japanese models in the product mix because of their high reliability.
4. Yes, COTS was interfaced with GFE which sped the acquisition process; where pure COTS would have slowed the acquisition process.
5. The advantages of using COTS outweigh its disadvantages.
6. Yes, only if the USAF develops a uniform support structure for COTS.
7. Yes, COTS systems were extremely reliable and filled a critical gap for the USAF.

Four of the 17 managers made no comments about buying other types of COTS for USAF missions. One manager did not recommend buying more COTS until the USAF's acquisition process is streamlined to buy COTS products. However, the other 12 managers made additional recommendations for other COTS systems that could be bought:

1. The government should have bought more COTS long ago, especially systems with replaceable circuit cards.
2. More COTS should be purchased with CLS. Tradeoff decisions have to be made depending on the support requirements, amount of funding available, and manpower. The USAF should study the COTS program to see if it can satisfy its war essential mission before buying.
3. Use COTS systems where possible except applications such as combat missions.
4. COTS systems must be evaluated case-by-case depending on the needs and requirements of the program.
5. More COTS should be purchased only after minimum data requirements are met.
6. Buying more COTS systems is good, but the system must be evaluated to stay in budget when replacing older systems.

7. Systems like computers can be applied any mission with creative approaches.
8. COTS advantages negate the impacts of constant configuration changes. Ruggedization for COTS remains a major concern.
9. COTS equipment like video equipment can be purchased by the USAF by taking advantage of past experience with contracts for COTS computers.
10. More COTS systems should be bought only if the systems have had a history of success in the commercial market.
11. COTS are suitable for applications such as training missions but not suitable for combat.
12. The USAF does not have to keep up with drawings or engineering designs. Since COTS technology is advancing rapidly, acquisition time is faster, and there is an existing economy of scale, the net result is greater savings than developed programs.

Question 14: Are there any other advantages/disadvantages that should be considered when buying COTS? Three of the 17 managers remained neutral on this question. The list of advantages mentioned by 12 of the 14 managers are listed below (some answers overlapped):

1. Initial purchases of COTS allow follow-on sole source acquisitions.
2. Ruggedized COTS puts the government in a better position than with a MIL-SPEC system.
3. The USAF saves time because COTS systems have already been developed with established parts networks. The program does not have to wait for R&D efforts.
4. COTS systems that have been used in the market place have proven reliability.
5. COTS systems are easier to buy than MIL-SPEC systems.
6. Buying COTS at a centralized government program office allows all participating agencies to benefit in

the savings as a result of economies of scale. Also, using one CLS contract to support COTS systems for multiple government agencies reduces administrative costs.

7. COTS systems are easier to support than MIL-SPEC systems.

8. Buying COTS allows the USAF to get new technology fast. The USAF can afford to replace systems more often because they cost less.

The list of disadvantages mentioned by ten of the 14 managers are listed below (some answers overlapped):

1. Provisioning communications systems is not cost effective. Technology in the communications equipment arena is moving too rapidly. By the time we get a system fielded, it has become obsolete.

2. Buying from the lowest bidder could easily result in a lack of worldwide product support. When a smaller company is required to build spares to support the USAF's worldwide mission, the firm may be forced to go out of business because the workload is too big.

3. The USAF needs a better method to track part numbers for COTS spares.

4. The USAF must strike a balance between too much or too little support for COTS systems to stay in budget. This may compromise mission accomplishment.

5. The USAF must pay much higher costs for modified COTS systems (such as paint schemes, special attachments, and requirements to meet other special standards).

6. When the government interfaces COTS equipment into GFE, performance standards of the COTS may be compromised.

7. Some government planners may falsely assume that the savings from less developmental costs for COTS systems will become available for other programs. R&D funding can not feasibly be used for other purposes.

8. High speed provisioning for LRUs is needed for COTS systems.

9. Stronger consideration should be given to CLS to reduce investment costs and the time to set up support.

10. USAF personnel need to get used to COTS types of manuals and training.

11. During the acquisition phase of a COTS program, life cycle system management for COTS systems must give more consideration to potential users and supporters.

12. The USAF at AFLC and the Sacramento ALC Technical Data division have too many people who are trained to treat COTS systems like fully developed systems.

13. COTS should not be used for combat uses.

Question 15: Will manpower and budget cuts affect the supportability of your system? How? Only one of the COTS programs will remain unaffected by manpower or budget cuts. Thirteen of the remaining 16 programs will only experience supportability problems from budget cuts. The primary reason given for problems stemming only from budget cuts is because either organic capability allows cross-utilization of maintenance personnel on the system, or the CLS contractor is only affected by budget cuts and not manpower cuts. Comments from the managers of these 13 programs are listed below (some overlapping occurred):

1. The USAF will be forced to go back to organic support at a higher cost.

2. Cross-utilization of organic maintenance staff will overcome the effects from manpower cuts.

3. Budget cuts will require the USAF to cut spares buys.

4. The USAF will cut flying hours for the program.

5. Fewer systems can be acquired which will result in a further backlog of requirements to be purchased.

This means older systems will require additional maintenance upkeep costs.

6. The USAF just place a two year moratorium on any additional systems. Additional cuts will require cut-backs on delivery orders for FY 1990.
7. The system's availability will decrease because the budget cuts will force the CLS contractor to spend more time on other COTS systems covered by this multiple CLS contract.
8. Since the system has not been fully installed, budget cuts will delay the final completion date (has slipped three times already).
9. Going to organic support from CLS will be disastrous because the USAF/DoD can not replicate the knowledge level of the CLS contract personnel.
10. Some budget cuts are not felt yet because some cuts in other programs have decreased the mission capability.

The remaining three COTS system will be affected by manpower and budget cuts. The managers' comments follow:

1. The program will revert to CLS which will drive support costs upward. The system is vital command and control equipment. Eventually, other lower priority systems will be cut back to sustain this programs' full mission capability.
2. After the remaining three and one half years of the five year warrantee ends, budget cuts for spares will require the USAF to salvage systems. Manpower cuts may eventually result in additional units going to salvage (for lack of technical capability).
3. The USAF developed the system in phases. Funding shorts will force the USAF to end the current installation phase prematurely.

### Conclusion

The data collected from the telephone interviews allow the reader to ascertain if the Investigative Questions in

Section I have been answered. The questions are reprinted with succeeding answers.

Question 1: What impact does the new acquisition initiatives created by the Defense Acquisition Improvement Act of 1986 have on the current logistics planning process for Air Force COTS system? Constructive answers to questions 1 and 2 by the telephone interviewees demonstrated the questionnaire had answered this question. The USAF has contributed to buying more commercial systems for DoD missions in the CONUS and around the world since the 1986 Act. The missions include administrative and operational support from the President down to military field units. Only a few of the programs in this study were strictly COTS hardware. The USAF made modifications to COTS systems for TEMPEST requirements, paint schemes, software requirements, and other installation criteria. However, significant savings were achieved where COTS hardware (with no modifications) were incorporated into existing systems.

Question 2: How have Air Force logisticians adapted to shorter acquisition cycles for COTS systems and equipment? Constructive answers to questions 3 and 5 by the telephone interviewees demonstrated the questionnaire had answered this question. Acquisition and logistics support contracts included flexible language to buy the equipment with lifetime CLS or escape clauses that allowed organic support in the future. Using CLS sped the fielding time of the COTS



programs especially when the vendors (or subcontractors) had highly developed support networks. When the USAF had to provision a COTS program, the provisioning process had to be accelerated so spares could reach the field at the same time the equipment arrived. Most COTS programs used commercially available manuals to prevent delays normally associated with writing MIL-SPEC technical orders.

Question 3: What creative techniques have logisticians used to protect the Government's (DoD and U.S. Air Force) operations from COTS systems that become prematurely obsolescent and retired for use by the Air Force? Constructive answers to questions 6, 8, 9, and 12 by the telephone interviewees demonstrated the questionnaire had answered this question.' Approximately one third of the COTS programs in this research had little or no risk from early obsolescence because the USAF required prime contractors to integrate COTS hardware into existing government owned systems. The risk was avoided also by requiring the follow-on CLS contractor to be fully responsible for spares and the system configuration for the length of the contract. Contractual language for some systems required the vendor to notify the USAF within six months if the company was discontinuing production or support of the COTS system. This allowed the USAF to decide whether to buy the designs or to transfer the manufacturer's support to third-party vendors.

In some cases, the USAF expected the useful life of the COTS system not to exceed a designated life span (such as seven or ten years). Thus, support requirements could be planned accurately until the system was programmed for disposition. There was a trend to have the USAF buy spares during the initial acquisition to protect the USAF from shortages in the market. Another concern suggested buying more technical data with the acquisition contract, but this belief was not prevalent among the managers. Another suggestion included flexibility in the CLS contracts to increase the number of CLS personnel when the COTS system expanded its operation.

Question 4: What kind of Air Force missions are best suited to use and support COTS equipment? Constructive answers to questions 13, 14, and 15 by the telephone interviewees demonstrated the questionnaire had answered this question. Suggested systems for COTS candidacy included electronic equipment, computers, test equipment, mobile construction equipment, general purpose vehicles, small business-type aircraft, video equipment, and equipment suited for the classroom (not to include military trainers). Systems considered not suitable for COTS are hardware intended for combat uses or any equipment that requires modifications. No consensus was agreed upon for the level of modifications. However, at least two managers recommended

no system should be considered for COTS if the USAF is considering plans to modify the commercial equipment.

Question 5: What have Air Force acquisition and logistics managers done to maximize the benefits of COTS systems and to minimize any other risks associated with buying and supporting these systems? Constructive answers to questions 7, 10, and 11 by the telephone interviewees demonstrated the questionnaire had answered this question. Most of the programs used flexible contracts to minimize the risk for supporting and buying COTS equipment. Some contracts also had flexibility built-in to allow different types of training for both government and CLS personnel. The flexible training methods allowed the USAF to adapt to changing requirements throughout the life of the systems. Occasionally, the USAF had to adapt to unusual packaging, handling, storage, and transportation (PHS&T) requirements to prevent damage to COTS equipment. CLS contractors were held fully responsible for PHS&T problems. The acquisition and CLS contracts for COTS systems were the keys to achieving successful results.

Lessons learned by these managers and recommendations for further research will continue in Section VI.

## VI. Lessons Learned and Recommendations

### Introduction

This section will present the lessons learned by the logistics managers who supported the 17 COTS programs in this research study. The research study will end with recommendations for areas of improvement and further study.

### Lessons Learned

1. When the acquisition time for COTS systems is shorter than the provisioning process, USAF planners must streamline the provisioning process so spares can be located in the field at the same time the new systems arrive.

2. When large COTS systems (such as computers/telephone switches) are integrated with MIL-SPEC equipment, USAF managers follow a more traditional development process. The COTS system chosen for this application is composed of state-of-the-art technology, but comes from name brand vendors with a large/established commercial market. Small vendors are avoided because the USAF's large scale buying and worldwide support requirements may over tax these weaker companies that have small scale operations.

3. USAF planners have competed maintenance support for some COTS systems between local contractors and typical government organizations to save support costs. This technique is used for systems that have a large pre-existing vendor/factory trained support network within the CONUS (or worldwide).

4. USAF/government planners are getting smarter about buying COTS systems with full support (CLS). To lower the cost of this support, the CLS contracts give the USAF the flexibility to choose cheaper levels of CLS for bases with less rigorous support requirements.

5. The USAF is getting smarter with CLS contracts by hold the CLS contractor responsible for: 1) critical spares availability, 2) system/mission effectiveness rates, and 3) configuration control.

6. The USAF avoids mandating training for CLS contractor personnel to lower training support costs. However, the contracts may have monetary penalty clauses against the

contractor if the COTS system fails to operate at a desired effectiveness level. Therefore, CLS personnel must be qualified/trained by the CLS contractor to meet the USAF's requirements.

7. When the life of a COTS system is longer than ten to 20 years, USAF planners may prove that organic logistics support may be less expensive than CLS. Usually, COTS systems with longer life expectancies have static core designs and operate in a stand alone configuration (rather than integrated with MIL-SPEC GFE).

8. USAF planners who choose CLS for their COTS programs are opting for longer contracts (greater than five years) to stabilize long term support costs. The longer contracts also allow the USAF to retain the "corporate knowledge" of the contractor's site personnel.

9. Some USAF planners are taking the lead for the DoD by offering administrative support for COTS systems. This wider level support allows for larger economies of scale buying and less administrative support costs per COTS program.

10. Some acquisition contracts for COTS systems are offering USAF MAJCOMs and bases a cafeteria style variety of products and levels of support on a single contract. This variety allows the USAF to buy products and support to satisfy many different user requirements.

11. USAF planners for COTS programs are requiring software/hardware CLS contractors to subscribe to vendor services that provide information about upgrades and changes to the COTS systems. The USAF is giving more freedom to the CLS contractors to choose the upgrades (at the contractor's expense). This allows CLS contractors to keep these COTS systems operating at peak performance while lowering support costs. Thus, the CLS contractor could conceivably increase their profits if newer technology upgrades significantly reduce support costs.

12. Another trend with acquisition/CLS contracts allows the USAF/CLS contractor to upgrade or "refresh" the system with technology improvements after the system is installed and operating in the field. This feature gives the USAF the chance to exchange older subsystems and end items to lower support costs.

13. As COTS systems expand and take on larger missions, the USAF can add flexibility in the CLS contract with a clause for central/remote maintenance support. The USAF can negotiate with the CLS contractor to include additional

CLS personnel as more remotes are added to a centralized system, or the USAF and the CLS contractor can opt for a lower effectiveness level (especially good when budget reductions occur). Flexible training formats may also be included in the contract language to meet various training requirements for USAF/CLS personnel.

14. The USAF has also spread CLS contracts across multiple COTS systems to reduce the impacts of budget shortfalls. If the support budget decreases, the lower effectiveness levels can be renegotiated with the contractor to have a lesser impact on the users' missions than if the CLS contract had been for only one COTS system.

15. Another technique used to ease the impact of budget shortfalls is the use of phased program development. With each phase, desirable objectives are achieved. New phases add more objectives until the USAF achieves the ultimate program objective. If budget costs are drastic, a phase will be modified, extended, or terminated to prevent jeopardizing the support for earlier phase(s).

16. Training videos can be considered for bridging technology knowledge gaps when COTS systems are upgraded. The videos can serve as an initial operations and maintenance training technique until formal training can be arranged for USAF/CLS personnel.

17. Magnetic media is being used to store, retrieve, update, and work with commercial drawings and technical manuals. Coupled with USAF/commercial vendor review committees, changes to COTS systems drawings and manuals can be negotiated and changed much faster than paper media methods.

18. Where provisioned spares are used, the USAF has required the COTS vendor (in the acquisition contract) to supply critical parts to any worldwide operating location within 24 hours after receipt of order. By coupling this time requirement with equipment redundancy, the USAF may achieve near full-proof reliability with a COTS system.

19. The USAF governs the baseline for provisioned spares in some COTS programs to eliminate the need for site surveys and to speed the process to develop full depot support.

20. Multiple vendors for some COTS programs are used to prevent reliance on a sole source. Spreading these purchases across many sources reduces the risks that a system will become insupportable if a vendor discontinues support or manufacturing capability for the system.

21. Customized paint is ordered for some COTS systems to meet special USAF requirements, but the core design of the COTS system is left original.

22. Programs that are especially good candidates for COTS technology are those where the vendor has established a worldwide parts network.

23. When only a few COTS systems are purchased (such as aircraft and mainframe computers), lower levels of support can be considered when the contract includes on-site factory technical representatives (or factory trained Air Force Engineering and Technical Service equipment specialists). The technical representatives serve as site experts, provide training to CLS/government personnel, and perform emergency maintenance when required.

24. Depot logistics support or restoration to "like-new" conditions are not considered for COTS systems that experience frequent configuration changes (such as vehicles). Instead, the system is scheduled for replacement after it experiences a predetermined number of hours/miles/years of operation.

25. A commerciality clause is used by some COTS acquisition contracts to insure the system is established on the commercial market for more than 12 months before the USAF buys the system. This prevents buying systems that do not have mature support networks in place.

#### Recommendations for Further Improvement

1. Do not fully provision COTS programs. Provisioning is expensive, too long, and limits the capability of the commercial system.

2. Do not convert commercial manuals to MIL-SPEC technical orders. Teach USAF personnel at the organizational level how to understand and work with commercial manuals.

3. Speed/streamline the acquisition process for COTS systems by educating all of the USAF's personnel at the system program offices and ALCs in buying and supporting commercial systems and products (depart from using MIL-STD approaches for buying and supporting COTS).

4. Buy all engineering (type III) drawings when the COTS system is integrated with GFE (such as COMSEC equipment). This will protect the government from the effects of future changes that may occur (such as the dynamic changes that occurred in the COMSEC/TEMPEST GFE during the 1980s).

5. Cut lower priority programs before cutting support funding from command, control, and communications (C3) COTS systems.

6. Buy additional COTS automatic test equipment (ATE) to stock ahead and speed fielding to USAF/DoD users.

7. Consolidate many older MIL-SPEC systems that have diverse missions under single COTS program that is more reliable and offers new advanced technology.

8. Use extended warranties to support highly reliable COTS systems rather than using CLS or converting to organic logistics support.

9. Use more of the factory commercial manuals that come with COTS systems to self-train competent operations and maintenance staff where possible.

10. When COTS systems are highly visible to government executives, additional support costs should be considered to maintain these systems within more stringent standards (such as more hangar space for Lear jets that serve general officers and senior executive service civilians).

11. The USAF should buy COTS systems in larger quantities (especially if the USAF's demand is high) to enjoy larger economies of scale savings.

12. The USAF should not buy large COTS systems that are integrated into MIL-SPEC GFE until all USAF support staff for the COTS program are trained in commercial acquisition and support practices.

13. The USAF/government should study the manufacturer's war surge capability before buying a COTS system. If the USAF/government were to buy too many of the COTS systems from a company that could not keep up with a war surge, the government would be at a severe disadvantage.

14. The USAF should always be sure the COTS system is the most current model/version before committing the funding and delivery for the COTS program. If future models/versions are imminent, the USAF should delay the purchase until the most current technology can be obtained. Otherwise, the USAF should include wording in the acquisition contract to allow expansion to future upgraded models/versions of the COTS system.

15. Ruggedization for some COTS systems should be considered for severe duty environments instead of light duty applications. The USAF/DoD services may demand the



additional ruggedized features (if offered) to withstand the extremes of weather and near battlefield-like conditions.

16. COTS should not be used for battle use. The requirements of the battlefield (such as extreme vibration and environmental pressures standards) may not be satisfied with a COTS system, and could jeopardize the lives of our personnel.

17. The USAF should buy more COTS items with interchangeable (slide-in) electronic circuit boards (ECBs).

18. The USAF needs to give more consideration to potential users and supporters of COTS programs.

#### Recommendations for Further Research

The USAF needs additional research to find COTS sources from foreign markets to enhance trade relationships with countries that have "friendly-nation" status. For example, one manager for COTS products felt Japanese made vehicles had a proven record for reliability that rivalled U.S. manufactured vehicles. Other foreign manufactured technologies should be found that could enhance other USAF non-combatant missions. The added goodwill from buying from our friendly nations could go a long way to help preserve U.S. foreign relations.

Research is needed to find the practical methods to streamline the USAF's acquisition and support structure for buying COTS systems. Caution is needed when generalizing from this research study because only a minimal number of COTS systems were studied, however, every COTS program of this study had peculiarities in their support structures. The amount of difference between COTS programs should not be

discouraging to USAF managers who want to find similarities between COTS products. There are many similarities in the acquisition and support contracts that may be useful when considering other COTS systems. This useful information may be copied in whole or in part to other contracts to speed the acquisition process for newer COTS programs.

Additional research should be conducted to identify all COTS programs that have successfully satisfied their USAF mission requirements and have met budget constraints. By identifying all of the successful programs, future researchers can develop higher levels of confidence from the lessons learned by USAF managers who met rigorous budget constraints. The apparent cutbacks in military spending for the 1990s will require austere planning. The lessons learned from planning in austere times may also lead future USAF managers to satisfy new mission requirements more efficiently. More efficient planning and buying methods will allow the USAF to buy more war fighting capabilities with the same budget.

The USAF should conduct further research in the area of maintenance support for COTS programs. This thesis research did not confidently conclude from the data that maintenance support had improved for COTS programs. By collecting more data on COTS programs, the USAF could avoid pitfalls with acquisition and CLS contracts and improve maintenance support for future COTS programs.

With the recent emphasis about buying more commercial products in the DoD and the effects of shrinking budgets, the Air Force has taken a pro-active lead among the service components to focus on acquiring the latest technology directly from the commercial market. For example, the USAF has made plans to reorganize the Air Force Communications Command at Scott AFB, IL beginning 1 October 1990 to put more emphasis on buying and supporting high technology communications equipment/systems like COTS programs.

Basically, AFCC's reorganization will reduce the MAJCOM's worldwide support structure to a centralized functional command. The divestiture will consist of giving the base communications and combat communications organizations to the USAF's flying commands. The remnant of AFCC will consist of a headquarters staff, the Technical Information Center (TIC), and the engineering and installation (E&I) organizations. The centralized structure will focus on standardizing USAF communications systems and identifying the latest technological improvements in communications systems that may be used by the USAF. Potential communications systems will be fully evaluated and tested for areas such as reliability, maintainability, and quality. MIL-SPEC and COTS communications systems will continue to be developed, evaluated, and installed by the new AFCC organization for the USAF.

## Appendix: A

### Interview Questionnaire For Logistics Support for Commercial Off-the-Shelf U.S. Air Force Equipment

by Charles L. Clayton

#### Sample Interview Questionnaire

In March of 1985, the Air Force Acquisition Logistics Center (AFALC) published a series of lessons learned bulletins about Commercial Off-The-Shelf (COTS) equipment. These bulletins were designed to assist Program Managers, Deputy Program Managers for Logistics, and Integrated Logistics Support Managers in commercial equipment acquisition programs. The introduction section of the AFALC bulletins points out an important critical area used by logisticians who develop support systems for COTS equipment and systems:

"One of the most serious drawbacks of COTS is the government's lack of configuration control. This affects many areas in the life cycle cost (LCC) of COTS. It affects technical manuals, spares provisioning, integration into systems, support equipment requirements, calibration procedures, and maintainability to name a few. Unless configuration control is contracted for, the government has no control."

Configuration control is an extremely important issue when buying COTS systems, but there are other very important issues to consider also such as: training, support equipment, unverified technical orders, design interface concerns, and maintenance support. These critical areas become part of the overall complex logistics support process managers consider when analyzing the life cycle costs for COTS systems. COTS systems hold a primary advantage over developmental items (MIL-SPEC) because much of the analysis has already been accomplished by the vendor. This reduction in analysis time translates into significant cost savings to the Air Force because we do not have to wait for the developmental efforts as we do with MIL-SPEC systems.

Logistics support for COTS systems, however, may present our managers with significant challenges. Current literature on logistics support for COTS systems do very little to assist Air Force managers because the literature is restricted only to single issues or general ideas about how to plan for these systems. With this lack of specific

guidance, Air Force managers must rely on past experience or get help from those who have bought and planned support for COTS systems.

The purpose of this interview will be to identify current trends among Air Force logisticians who deal with a variety of COTS systems throughout the Air Force and to compile the lessons they learned when buying COTS systems. Their answers will be summarized into a specific list of ideas and procedures used to support the unique requirements for COTS systems. This research effort will provide future planners with relevant information that will help them to buy COTS systems.

The attached list of questions will be used as a guide during the phone interview. Mr. Charles Clayton, a graduate student at the Air Force Institute of Technology, will be conducting the interviews on your COTS system. The results of the interview will be compared with other interviews to develop a common thread of management techniques or the experts' lessons learned concerning COTS systems they bought and supported for use in the Air Force. The interview will last approximately 30 minutes.

Interview  
Questionnaire  
On COTS Systems

Interviewer: \_\_\_\_\_  
Name \_\_\_\_\_ Organization \_\_\_\_\_

Location: \_\_\_\_\_  
Base \_\_\_\_\_

Tel. #: \_\_\_\_\_

Program Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Describe your \_\_\_\_\_ COTS system, what does it support, who uses it, and name the bases that use it?

2. Has this COTS system been modified for government use, or is the system pure COTS purchased from the vendor as-is just like the civilian sector?

If you answered yes, how is the system modified?

3. How is the \_\_\_\_\_ COTS system supported:

	Organizational	Intermediate	Depot
CLS	_____	_____	_____
Organic	_____	_____	_____

If the COTS system is supported by CLS, is the CLS planned for the life of the system, or is the CLS subject to competitive negotiation at specific intervals?

Is there more than one CLS contractor for the system?  
If so, are there any discrepancies as to which contractor maintains/repairs the item(s)?

4. How did the maintenance support concept degrade or improve for the \_\_\_\_\_ COTS system?

What steps were required to resolve any problems?

5. Discuss the role of commercial (or military type) drawings\manuals for the \_\_\_\_\_ COTS system.

Are they adequate?

Do they get updated as changes are made to the equipment?

What steps were required to resolve any problems?

6. Was it necessary to integrate the \_\_\_\_\_ COTS system into any other pre-existing systems or facilities?

Who performed the integration (prime contractor, CLS contractor, or the government)?

Is the configuration unique to the Air Force?

What problems were encountered during and after the integration, and how were they resolved?



7. What type of training format is required?

Who provides it?

Who receives it?

Is it necessary?

Is it adequate?

Are there any problems with the training?

8. Are critical failure parts easily accessible for the  
\_\_\_\_\_ COTS system?

Who provides the spare parts?

Are there any delays or problems in getting the parts  
needed to keep the system operational?

What steps were required to resolve any problems?

9. Describe how the configuration management/control is impacted by spare parts for the COTS \_\_\_\_\_ system.

What impact is created when the configuration of the COTS system changes?

Does the system remain operational after the configuration changes?

What steps were required to resolve any problems?

10. Describe how your staff has adapted to any configuration changes with the \_\_\_\_\_ COTS system.

What steps were required to resolve any problems?

11. Does your \_\_\_\_\_ COTS system have any support problems due to improper packaging, handling, storage, and transportation? Facilities? Other?

What steps were required to resolve any problems?

12. If you could change anything about the system, what would you like to do to improve the logistics support for the \_\_\_\_\_ COTS system?

13. Would you recommend buying more of these COTS systems if you knew what you know now, and why or why not?

Would you recommend COTS for other systems? What type and why?

14. Are there any other advantages/disadvantages that should be considered when buying COTS?

15. Will manpower and budget cuts affect the supportability of your system? How?

## Appendix B: Glossary

Acquisition - The act of gaining possession of something or to get by one's own efforts (American Heritage:75).

Acquisition Logistics - The process of systematically identifying and assessing logistics alternatives, analyzing logistics alternatives, analyzing and resolving ILS (integrated logistics support) deficiencies, and managing ILS throughout the acquisition process (Department of the Air Force Pamphlet 800-34:1-1).

Developmental Item - Also known as a MIL-SPEC item (see definition below)

Integrated Logistics Support - ILS is defined as (DoD Integrated Logistics Support Guide:1-1):

A disciplined, unified, and iterative approach to the management and technical activities necessary to:

- a. Define the support for a system
- b. Design for support for the system
- c. Acquire the support for the system
- d. Provide the support for the system

Life Cycle Cost - LCC is defined as (DoD Integrated Logistics Support Guide:6-1):

The LCC estimate is comprehensive . . . it covers all costs to the Government during the system's life cycle. Research and development, production, operation and support, and disposal costs are included in LCC.

Logistics Support Process - The ILS process (see definition above) is used to put a system into operation and to support it for its intended useful life.

Logistics Support Analysis - LSA is defined as (DoD Integrated Logistics Support Guide:5-1):

An analytical effort for influencing the design of a system and defining support system requirements and criteria. The objective of LSA is to ensure that a systematic and comprehensive analysis is conducted on a repetitive basis through all phases

of the system life cycle in order to satisfy readiness and supportability objectives.

MIL-SPEC - MIL-SPEC equipment is defined as:

The classic military approach to design and construction: a government design for government use. The Government is financing the design effort, will ultimately own and control the design, and intends that it be rugged enough to withstand battlefield use. The design philosophy and selection of parts are strictly according to military specifications and standards, and, typically, the cost is high (Sacramento:1).

Nondevelopmental Item - The U.S. Congress defined nondevelopmental items as follows (U.S. Congress:10 U.S. Code 2325):

(1) Any item of supply that is available in the commercial marketplace;

(2) Any previously developed item of supply that is in use by a department or agency of the United States, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(3) Any item of supply in paragraphs (1) or (2) that requires only minor modification in order to meet the requirements of the procuring agency; or

(4) Any item of supply that is currently being produced that does not meet the requirements (1), (2), or (3) solely because the item-

a. Is not yet in use; or

b. Is not yet available in the commercial marketplace.

Off-the-shelf (or COTS) - Commercial-off-the-shelf (COTS) items are defined as a subset of nondevelopmental items, which do not require development by government planners. The more accepted definition for COTS type equipment is as follows: "a commercial item is an item developed and used for other than government purposes; sold or traded to the general public in the course of normal business operations, and (ideally) used unchanged ("off-the-shelf") when acquired by the government" (Sacramento:1).

Procurement - An item obtained or acquired to bring about a solution or some effect (American Heritage:989).

Provisioning - The provisioning process is defined as follows (MIL-STD-1388-1A):

"The process of determining and acquiring the range and quantity of spares and repair parts, and support and test equipment required to operate and maintain an end item of material for an initial period of service.

## Bibliography

- American Heritage Dictionary (2nd Edition, 1982).  
Boston MA: Houghton Mifflin Company, 1982.
- Ashjian, John, Item Management Specialist. Telephone interview. SA-ALC/MMTEDA, San Antonio ALC TX, 3 May 1990.
- Barrett, Major Bruce, Integrated Logistics Management Specialist. Telephone interview. HQ ESD/ICSL, Hanscom AFB MA, 19 June 1990.
- Bleau, Richard, Senior Acquisition Manager. Telephone interview. AFSC ESD/ALL, Hanscom AFB MA, 3 October 1989.
- Brantley, Cheryl, Logistics Management Specialist. Telephone interview. WR/ALC/MMVV, Warner-Robins ALC GA, 30 May 1990.
- Chambless, Marsha, Program Manager. Telephone interview. OC/ALC/MMAA, Oklahoma City ALC OK, 17 May 1990.
- Clark, Allen, Logistics Management Specialist. Telephone interviews. AFCC/EID (AL), Tinker AFB OK, 13 February through 2 May 1990.
- Cohen, Barry L. and Stewart L. Manley. An Evaluation of the Packard Commission Recommendations Encouraging Commercial-Style Competition and Expanding the Use of Commercial Products, August 1986 - May 1987. Final Report, NDU/ICAF-87-A7A. Industrial College of the Armed Forces, Washington DC, May 1987 (AD-B116372L).
- Corrothers, Capt Jeffery. Integrated Logistics Systems Manager. Telephone interview. HQ ESD/SRI, Hanscom AFB MA, 18 June 1990.
- Department of the Air Force. Acquisition Logistics Management. AFLC/AFSC Pamphlet 800-34. Washington DC: HQ USAF, 13 April 1987.
- Integrated Logistics Support (ILS) Program. AFR 800-8. Washington DC: HQ USAF, 25 June 1986.
- Department of Defense. Acquisition and Support of NDI. DOD 5000.37. Washington DC, November 1988.

- . DOD Report to the Armed Services Committees of the Senate and the House of Representatives on Nondevelopmental Item Acquisition, Progress and Impediments. Washington DC, December 1987a.
- . Integrated Logistics Support Guide. Washington DC, May 1986.
- . Logistics Support Analysis (LSA). MIL-STD-1388-1A. 11 April 1983.
- . Use of Commercial Components in Military Equipment. Final Report of the Defense Science Board 1986 Summer Study. Office of the Undersecretary of Defense for Acquisition, Washington DC, January 1987b.
- Emory, C. William. Business Research Methods (Third Edition). Homewood IL: Richard D. Irwin, Inc., 1985.
- Feder, John H. Nondevelopmental Item Acquisition. Student essay. Army War College, Carlisle Barracks PA, March 1987 (AD-A180156).
- Fordham, Gary. Logistics Management Specialist. Telephone interview. WR-ALC/MMIEM, Robins AFB GA, 27 June 1990.
- Foskey, Gasten, Item Management Specialist. Telephone interview. WR/ALC/MMVV, Robins AFB GA, 8 May 1990.
- Hansen, General Alfred G., Commander of Air Force Logistics Command and Bernard F. Benard P. Randolph, Commander of Air Force Systems Command. Joint AFSC/CC and AFLC/CC Letter re Commercial Off-the-Shelf (COTS) Supportability Working Group. Wright-Patterson AFB OH, 31 August 1989.
- Heilman, Stephan C. The Feasibility of Buying and Supporting Commercial 'Off-the-Shelf' Weapon System Components, August 1986 - May 1987. Final Report, NDU/ICAF-87-F13A. Industrial College of the Armed Forces, Washington DC, May 1987 (AD-B116112L).
- Herger, Ed. Integrated Logistics System Manager. Telephone interview. HQ ESD/TGL, Hanscom AFB MA, 11 June 1990.
- HQ AFCC/AFLC/AFSC. "Commercial Off-the-Shelf (COTS) Joint AFSC/AFLC/AFCC Major Command Review." Charter for the Air Force COTS Working Group, December 1989.



Jagt, 2nd Lt Daniel, Acquisition Manager. Telephone interview. SM-ALC/MMIK, McClellan AFB CA, 18 June 1990.

Mann, Paul. "Reagan Names Packard to Head Blue-Ribbon Management Panel," Aviation Week and Space Technology, 122:21-22 (24 June 1985).

Marshall, Maryanne, Logistics Management Specialist. Personal interviews. HQ ESD/ALL, Hanscom AFB MA, 9-13 April 1990.

Martinez, Danny, Inventory Management Specialist. Telephone interview. SA-ALC/MMTEB, San Antonio ALC TX, 17 May 1990.

Materna, Lt Col Robert D. and Capt Richard A. Andrews. Class handout distributed in LOGM 367, Logistics Systems Overview. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, May 1988.

Marquis Who's Who in America (45th Edition, 1988-1989). Womette IL: Macmillan, Incorporated Company, 1988.

Packard, David. A Quest for Excellence, Final Report to the President by the President's Blue-Ribbon Commission on Defense Management, June 1986.

Rakers, Vernon, Logistics Management Specialist. Telephone interview. HQ AFCC/LGLD, Scott AFB IL, 29 April 1990.

Sacramento Air Logistics Center, Air Force Logistics Command. "The COTS Book." SM-ALC/MMA Draft 3. McClellan AFB CA, 31 March 1989.

Schumacher, Gerald A. Management and Support of Commercial Off-the-Shelf (COTS) Computer Resources Used in Weapon Systems Applications. MS thesis, AFIT/GSM/LSY/88S-24. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1988 (AD-A201589).

Secretary of the Air Force, Headquarters United States Air Force. "Draft Non-Developmental Item Handbook." SAF/AQXA letter with 1 attachment. Washington DC, 1 March 1988.

Tanner, Charles, Integrated Logistics Systems Manager. Telephone interview. HQ ESD/SROL, Hanscom AFB MA, 18 June 1990.

Teeter, Lyle, Senior Logistics Manager. Talking paper for briefing, "COTS-Time for a Change." Address to General Hansen, commander of Air Force Logistics Command. Logistics Requirements Conference, HQ AFLC, Wright-Patterson AFB OH, 15 March 1989a.

-----. Personal correspondence. HQ AFCC LGL, Scott AFB IL, 28 July 1989b.

U.S. Congress. National Defense Act for 1987. 10 U.S. Code 2325 Preference for Nondevelopmental Items. 100th Congress, First Session (1987). St. Paul MN: West Publishing Company, 1987.

Undersecretary of Defense Acquisition. Final Report of the Defense Science Board 1986 Summer Study, Use of Commercial Components in Military Equipment. Report to the Secretary of Defense (OSD) through the Undersecretary of Defense (Acquisition) (OUSD(A)). Washington DC, 15 January 1987.

Watring, Jerry, Logistics Management Specialist. Telephone interview. HQ AFLC/LOC/ATE, Wright-Patterson AFB OH, 3 May 1990.

Weber, Walter, Logistics Management Specialist. Telephone interview. OC/ALC/MMAO, Oklahoma City ALC OK, 7 May 1990.

Williamson, Mike, Logistics Management Specialist. Telephone interview. WR/ALC/MMVV, Warner-Robins ALC GA, 29 May 1990.

Wise, Capt Richard, Integrated Logistics System Manager. Telephone interview. HQ ESD/ICS, Hanscom AFB MA, 7 June 1990.

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[REDACTED] [REDACTED]

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 1990	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE LESSONS LEARNED FROM THE LOGISTICS SUPPORT FOR COMMERCIAL OFF THE SHELF U.S. AIR FORCE EQUIPMENT			5. FUNDING NUMBERS	
6. AUTHOR(S) Charles L. Clayton GS-11				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology Wright Patterson AFB OH 45433-6583			8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GLM/LSM/90S-11	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Little documentation exists on the role of supporting commercial off the shelf (COTS) systems bought by the Air Force. Current USAF policy does not address the dynamic nature of buying and supporting COTS systems. The logistics support challenges associated with COTS equipment were explored through telephone interviews with USAF managers. The focus of this study is on the lessons learned by planning logistics support for COTS before, during, and after the enactment of the Defense Acquisition Improvement Act of 1986. Recommendations were made to (1) not fully provision COTS programs, (2) not convert commercial manuals to T.O.s, (3) streamline the acquisition process for COTS systems, (4) buy COTS systems in larger quantities to enjoy the savings from larger economies of scale, and (5) buy all engineering (type III) drawings when the COTS system is integrated with GFE (such as COMSEC equipment). Recommendations for further research were to (1) find COTS sources from foreign markets to enhance trade relationships with countries that have "friendly-nation" status, (2) find the practical methods to streamline the acquisition and support structure for buying COTS systems, and (3) identify all successful COTS programs.				
14. SUBJECT TERMS Commercial Off The Shelf, COTS, Non-Developmental Items, Logistics Support, Lessons Learned			15. NUMBER OF PAGES 132	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	